Thomas A. Edison Papers

A SELECTIVE MICROFILM EDITION

PART II
(1879–1886)

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THOMAS A. EDISON PAPERS

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THOMAS A. EDISON PAPERS

A SELECTIVE MICROFILM EDITION
PART II
(1879-1886)

REEL 29

NOTEBOOK SERIES (NBK-7)

Menlo Park Notebooks, #1 - #10

NOTEBOOK SERIES, 1879-1886

Several sets of technical notes and drawings comprise the Notebook Series for 1879-1886. They appear on the microfilm in the following order: (1) Menlo Park Notebooks, (2) New York Notebooks, (3) Fort Myers Notebooks, (4) Lamp Factory Notebooks, (5) Pocket Notebooks, (6) Technical Scrapbooks, (7) Unbound Notes and Drawings, (8) Oversize Notes and Drawings, (9) Undated Notes and Drawings. All of the bound notebooks, except for the technical scrapbooks and the pocket notebooks are standard-size, 6 inch x 9 inch notebooks containing between 280 and 290 pages. Edison began using these notebooks in November 1878, and he continued to use them throughout the remainder of his life.

(1) Menlo Park Notebooks, 1878-1882. These notebooks are the principal sources for documenting the invention and development of Edison's system of electric lighting and power. They also contain much material on the telephone, as well as scattered entries detailing work on electric railways, batteries, ore separation, telegraphy, and various other technologies. The entries in the early notebooks are primarily by Edison, Charles Batchelor, and Francis Upton. As the staff of the laboratory expanded, many other individuals began making entries in the notebooks. A few of the books contain entries from 1883, 1884, and 1885. The notebooks are numbered from 1 to 249. Approximately 70 books are missing from the set.

(2) New York Notebooks, 1884-1886. These ten notebooks were used at Edison's New York City laboratory, which was located above the offices of Bergmann & Company at Avenue B and 17th Street. Most of the notes, drawings, and calculations are by Edison. There are also some entries by John F. Ott, Ezra T. Gilliland, H. DeCoursey Hamilton, Montgomery Waddell, and other laboratory assistants. The books deal with a wide variety of subjects, including electric lighting and power, telephony, telegraphy, mining, and the phonograph. Several books contain entries pertaining to Edison's search for a new force and his attempt to convert heat directly into electricity.

(3) Fort Myers Notebooks, 1886. These seven notebooks were generated at Edison's winter home in Fort Myers, Florida, which he constructed shortly before his marriage to Mina Miller in February 1886. Most of the entries are by Edison. There are also some entries by Mina Miller Edison, whose name also appears in these books as a witness. Many of the notes and drawings concern phonoplex and multiplex telegraphy, Edison's search for a new force, and his attempts to convert heat directly into electricity. There is also material relating to electric lighting, electric railways, spectroscopy, hearing aids, and numerous other items. One book contains notes about the layout of the grounds at the Fort Myers home.

(4) Lamp Factory Notebooks, 1886. These seven notebooks contain notes, drawings, and calculations relating to experiments performed at Edison's lamp factory in Harrison, New Jersey. Most of the entries are by Edison and John F. Ott. One book contains entries by Mina Edison. Another book was used primarily by Ezra T. Gilliland. In addition to the lamp experiments, these books also contain notes and drawings pertaining to telephones and phonographs, along with some material dealing with the phonoplex and with other systems of railway telegraphy.

(5) Pocket Notebooks, 1878-1886. These are a group of miscellaneous books, generally measuring about 3 to 4 inches in width and 6 to 7 inches in height. Included among the pocket notebooks is a set of six journals kept by Charles P. Mott between March 1880 and March 1881 to record daily activities at the Menlo Park Laboratory. The other eight pocket notebooks were used primarily by Edison. The entries relate to a wide variety of topics, including electric lighting, telephony, telegraphy, the phonograph, and hearing aids.

(6) Technical Scrapbooks, 1881-1888. These seven disbound scrapbooks contain notes and drawings by Edison, which he subsequently gave to his attorneys and draftsmen to work into patent applications. Most of the material concerns electric lighting but there are also entries relating to telephony, telegraphy, electric railways, and other topics.

(7) Unbound Notes and Drawings, 1879-1886. This set of technical notes and drawings relates primarily to electric lighting. Other topics include telephony, telegraphy, and electric railways. The documents appear on the microfilm in chronological order.

(8) Oversize Notes and Drawings, 1879-1886. This is a set of technical documents, primarily drawings, that are too large to fit in standard-size document folders. Most of the material relates to electric lighting. A few drawings concern telephones and electric railways. The documents appear on the microfilm in chronological order, but many of them are undated. Included also among the oversize notes and drawings is a separate set of Menlo Park machine shop drawings, dating from 1879 and 1880. These drawings were produced by the staff of the laboratory's machine shop prior to the production of experimental devices and models. Almost all of the drawings relate to work on the electric light, but there are a few miscellaneous drawings of the telephone.

(9) Undated Notes and Drawings. These technical documents relate primarily to electric lighting. Other topics include telephony, telegraphy, and electric railways. The notes and drawings appear on the microfilm in the following order: (a) Menlo Park period, 1879-1881; (b) New York period, 1882-1886; (c) drafts of caveats and patent applications.

Laboratory notebooks and other technical notes and drawings can also be found in the Charles Batchelor and Francis R. Upton collections (Special Collections Series).

Numbering Systems for Edison's Notebooks

Over the years a variety of different numbering systems have been employed by Edison and others to identify the notebooks used at Menlo Park and the later laboratories. Affixed onto the front cover of most of the standard-size Menlo Park notebooks is a label containing the inscription: "From the Laboratory of T. A. Edison. Menlo Park, N. J. No. _____." The numbers themselves run from 1 through 249 and were probably assigned to the books before they were put into use. The numbered books do not progress in strict chronological order, and related books sometimes contain widely separated Menlo Park numbers. About seventy of the numbered notebooks are missing from the collection at the Edison National Historic Site. There are also a few notebooks whose damaged labels obscure any numbers that may once have been affixed to them. This is the only numbering system that was consistently in use during the time the books were being used in the laboratory and, for this reason, the books are organized on the microfilm in the order of their Menlo Park number.

Many of the Menlo Park notebooks also contain a second numbered label affixed onto the front cover several inches above the Menlo Park label. These labels were probably added to the books during the 1890s at the time they were sent to the General Electric Board of Patent Control in New York City. With only a few exceptions, all of the books containing the second numbered label also have the Board of Patent Control's bookplate pasted onto their inside front covers.

For the first thirty-four Menlo Park notebooks, the two sets of numbers are identical. Thereafter, the second set of numbers progress in the same sequence as the Menlo Park numbers, but many of the notebooks lack the second number and the General Electric bookplate. Menlo Park Notebook #249, the last numbered book in the series, also has a second label bearing the number 147. Similar labels appear on a few other notebooks. Two of the New York notebooks are numbered 148 and 149. The six pocket notebooks used by Charles P. Mott are numbered 150-155, and one other pocket notebook is numbered 156.

Unlike the Menlo Park notebooks, the notebooks used at the laboratories in New York, Fort Myers, and the Harrison lamp factory do not contain a standard printed label or a standard notebook number. Some of these books, however, do have a small numbered label affixed to their spines. The numbers range from 23 to 35. Many of the Menlo Park notebooks lacking the General Electric bookplate contain similar labels, with numbers ranging from 2 to 22. These numbers were probably affixed to the books after Edison's move to West Orange in 1887. Over 100 books with these small numbered labels are found among the West Orange notebooks. Book 1 and Book 36 both date from 1887.

Beginning in the late 1930s, the archivists at the West Orange Laboratory began assigning "N-numbers" to the standard-size notebooks used by Edison at Menlo Park and the later laboratories. A similar number with the prefix "PN" was assigned to each of the pocket notebooks. This six-digit number corresponds to the first dated entry in the notebook. For example, a notebook whose first dated entry was for November 9, 1878 would carry the number N-78-11-09. Unfortunately, this number is not always a reliable indicator of the date when a book was first used. Many of the books were in use for a long period of time before any entry was dated, and hundreds of other books contain no dated entries. Moreover, subsequent research has revealed that many of the supplied or conjectured dates are inaccurate. For these reasons, the N- or PN- number should never be used as the basis for dating a notebook.

The following is a list of all the standard-size notebooks and the various numbers that have been assigned to them.

List of Standard-Size Laboratory Notebooks, 1878-1886

MP#	Label #	Spine #	N-Number	Date	G.E. Bookplate
1	1		78-11-28	1878-1879	X
2	2		78-11-22	1878-1879	X
3	3		78-11-21	1878-1880	X
4	4		78-12-04.2	1878-1879	X
5	5		78-12-02	1878-1879	X
6	6		78-12-04.1	1878-1879	X
7	7		78-12-11	1878-1879	X
8	8		78-12-20.2	1878-1879	X
9	9		78-12-15.1	1878-1879	X
10	10		78-12-16	1878-1879	X
11	11		78-12-28	1878-1879	X
12	12		78-12-20.1	1878-1879	X
13	13		79-01-01	1879	X
14	14		78-12-31	1878-1879	X
15	15		78-12-20.3	1878-1879	X
16	16		79-01-21	1879-1880	X
17	17		79-04-21	1879	X
18	18		79-01-12	[1879]	X
19	19		80-03-26	1880	X
20	20		79-02-24.1	1879	X
21	21		79-04-08.1	1879	X
22	22		79-03-10.1	1879-1880	X
23	23		79-01-19	1879	X
24	24		79-01-14	1879-1880	X

MP#	Label #	Spine #	N-Number	Date	G.E. Bookplate
25	25		79-04-03	1879-1880	X
26	26		79-02-20.1	1879	X
27	27		79-02-14	[1879]	X
28	28		79-02-15.1	1879	X
29	29		79-02-15.2	1879	X
30	30		79-04-08.2	1879-1880	X
31	31		79-02-24.2	1879	X
32	32		79-03-10.2	1879-1880	X
33	33		79-01-00	[1879]	X
34	34		79-03-25	1879	X
35			[Missing]		
36			[Tannebaum Library, Dearborn]		
37	35		79-07-07.1	1879-1880	X
38	36		79-07-07.2	1879	X
39	37		79-11-21	1879-1880	X
40	38		79-03-31	1879-1880	X
41	39		79-12-09	1879-1880	X
41.2	40		79-10-18	1879-1880	X
42	41		79-12-19	1879-1880	X
43			[Missing]		
44			[Missing]		
45	42		79-04-09	1879	X
46	43		79-02-10	1879	X
47	44		79-03-20	1879	X

MP#	Label #	Spine #	N-Number	Date	G.E. Bookplate
48	45		79-07-05	1879-1880	X
49			[Missing]		
50		5	80-04-17	1880, 1884-1885	
51	46		80-03-29	1880	X
52	47		79-07-31	1879-1880	X
53			80-03-14	1880	
54			[Missing]		
55	48		80-01-28	1880	X
56	49		79-07-25	1879-1880	X
57	50		80-03-06	1880	X
58			80-01-31	1880	
59	51		80-01-26	[1879-1880]	X
60	52		80-10-25	1880	X
61			[Missing]		
62			[Missing]		
63	53		80-02-08.1	1880	X
64			[Missing]		
65			[Missing]		
66		3	80-02-08.2	1880	
67	54		80-01-02.1	1880	X
68	55		80-03-19	1880	X
69			[Missing]		
70	56		80-01-02.2	1880	X
71	57		80-01-03	[1880]	X
72		4	80-03-31	1880	
73	58		80-02-02	1880	X

MP#	Label #	Spine #	N-Number	Date	G.E. Bookplate
74	59		80-01-02.3	1880	X
75		6	80-06-10	1880	
76			80-01-30	[1880]	
77	60		79-06-16.1	1879	X
78	61		79-12-27	1879-1880	X
79	62		79-06-16.2	1879-1880	X
80	63		79-06-12	1879-1880	X
81			[Missing]		
82	64		80-03-15	1880	X
83			79-12-00	[1879-1880]	
84	65		80-01-02.4	1880	X
85	66		79-08-22	1879	X
86	67		79-09-18	1879-1880	X
87	68		80-10-23	1880-1881	X
88	69		79-08-28	1880-1881	X
89	70		80-02-06	1880	X
90			[Missing]		
91			[Missing]		
92			[Missing]		
93			[Missing]		
94			[Missing]		
95	71		80-00-03	[1880-1881]	X
96			79-09-20	1879-1880	
97			[Missing]		
98			[Missing]		
99			[Missing]		

MP#	Label #	Spine #	N-Number	Date	G.E. Bookplate
100	72		81-04-12	1880	X
101			[Missing]		
102	73		80-06-28	1880	X
103	74		80-06-29	1880	X
104	75		80-07-05	1880-1881	X
105	76		80-06-02	1880	X
106			80-09-28	1880-1881	
107	108		80-04-02	[1880-1881]	X
108	77		80-07-02	1880	X
109			[Missing]		
110	78		80-08-00	[1880]	X
111	79		80-08-18	1880	X
112	80		80-07-23	1880	X
113	81		80-06-14	1880	X
114	82		80-08-10	1880-1881	X
115		7	80-07-19	1880	
116		8	80-07-27	1880	
117			80-07-10	1880-1881	
118			[Missing]		
119	83		80-09-27	1880	X
120	84		80-11-25	1880	X
121	85		80-10-15.1	1880-1881	X
122			[Missing]		
123	86		80-08-17	1880	X
124	87		80-11-18	1880	X
125	88		80-11-16	1880	X

MP#	Label #	Spine #	N-Number	Date	G.E. Bookplate
126	89		80-07-21	1880	X
127	90		80-00-05	[1880]	X
128	91		80-00-06	[1880]	X
129	92		80-09-09	1880	X
130	93		81-00-02	[1880]	X
131	94		80-07-00	[1880]	X
132	95		80-08-13	1880	X
133	96		80-00-01	[1880-1881]	X
134	97		80-08-09	1880,1884	X
135	98		80-07-30	1880	X
136	99		80-08-11	1880	X
137	100		80-07-16	1880	X
138	101		80-12-17	1880	X
139	102		80-01-07	[1880-1881]	X
140	103		80-12-21	1880	X
141			[Missing]		
142	104		80-11-27	1880	X
143		22	82-11-14	1882-1883	
144			[Private Collection]		
145	105		82-12-04	1882-1884	X
146	106		79-02-20.2	[1880-1881]	X
147			[Missing]		
148	110		80-10-08	1880	X
149	111		80-10-15.2	1880	X
150	112		82-12-21	1882-1885	X
151	113		80-06-01	1880	X

MP#	Label #	Spine #	N-Number	Date	G.E. Bookplate
152	114		80-01-13	1880-1881	X
153	115		80-09-11	1880-1881	X
154			[Missing]		
155			[Missing]		
156			[Missing]		
157	116		80-12-24.2	1880	X
158		17	81-03-22	1881	
159			[Missing]		
160	117		80-06-16.2	1880	X
161			81-10-18	1881-1882	
162			[Missing]		
163			[Missing]		
164			[Missing]		
165	118		81-00-01	[1880]	X
166			[Missing]		
167		9	80-09-03	1880	
168			80-12-13	1880-1881	
169			[Missing]		
170			[Missing]		
171	119		80-10-12	1880	X
172	120		80-11-15	1880	X
173			[Missing]		
174	121		80-11-09	1880	X
175			[Missing]		
176	122		80-00-07	[1880]	X
177	123		79-03-00	[1880-1881]	X

MP#	Label #	Spine #	N-Number	Date	G.E. Bookplate
178			[Missing]		
179	124		80-00-02	[1880]	X
180			[Missing]		
181			[Missing]		
182			[Missing]		
183			[Missing]		
184	125		80-06-16.1	[1881]	
185			[Missing]		
186	126		80-12-24.1	1880-1881	X
187	127		81-01-00	[1881]	X
188		11	81-01-25	[1881]	
189	128		80-00-04	[1881]	X
190	129		79-07-12	[1881]	X
191	130		81-01-21	[1881]	X
192	131		78-12-15.2	1878	X
193			[Missing]		
194			[Missing]		
195			[Missing]		
196			[Missing]		
197	132		82-06-08	1882	X
198	133		82-05-10	1882	X
199			[Missing]		
200			[Missing]		
201	134		81-05-21	1881	X
202			[Missing]		
203		20	82-05-15	1882, 1884	

MP#	Label #	Spine #	N-Number	Date	G.E. Bookplate
204	135		82-05-26	1882-1883, 1885	X
205			[Missing]		
206	136		81-03-09	1881-1883	X
207			[Missing]		
208			[Missing]		
209			[Missing]		
210	137		81-00-03	[1881-1882]	X
211			[Missing]		
212		10	81-05-23	1881	
213	138		81-05-14	1881	X
214		13	81-02-20	1881	
215	139		81-02-04	1881	X
216			[Missing]		
217			[Missing]		
218			[Missing]		
219			[Missing]		
220		16	81-07-11	1881	
221			[Missing]		
222			[Missing]		
223	140		81-04-06	1881	X
224		12	81-01-29	1881	
225			81-06-10	1881-1882	
226		15	81-06-22	1881	
227		19	81-03-24	1881	
228	141		81-08-30	1881	X
229		18	81-03-23	1881	

MP#	Label #	Spine #	N-Number	Date	G.E. Bookplate
230	142		81-03-18	1881	X
231			82-08-28	1882-1883	
232			[Missing]		
233			[Missing]		
234			[Missing]		
235	143		81-09-03	1881	X
236	144		81-03-11	1881	X
237			[Missing]		
238		21	82-06-21	1882, 1885	
239			[Hammer Collection, Smithsonian]		
240	145		81-03-04	1881	X
241			[Missing]		
242			[Missing]		
243			[Missing]		
244	146		81-02-18	1881	X
245		14	81-03-15	1881	
246			[Missing]		
247			[Missing]		
248			[Missing]		
249	147		82-03-12	1882-1883	
?	107		80-02-16	1880	X
?	109		80-10-01	1880, 1882	X
?			81-04-02	[1881-1882]	
?			81-04-30	1881	
?		2	80-01-16	1880	

MP#	Label #	Spine #	N-Number	Date	G.E. Bookplate
			N-84-05-29	1884	
		23	N-85-05-22	1885	
		24	N-85-05-28	1885-1886	
			N-85-10-01	1885-1886	
		25	N-85-10-03	1885	
			N-85-12-06	1885-1886	
		26	N-85-12-08	1885-1886	
			N-86-04-28	1886	
	148		N-81-09-13.1	1880s	
	149		N-81-09-13.2	1880s	
			N-86-03-18	1886	
		27	N-86-04-03.1	1886	
			N-86-04-03.2	1886	
			N-86-04-03.3	1886	
			N-86-04-05	1886	
		28	N-86-04-07	1886	
			N-86-08-17	1886, 1887	
		35	N-86-06-28	1886	
		29	N-86-07-07	1886	
		30	N-86-08-03	1886	
		32	N-86-08-24	1886	
		31	N-86-08-25	1886	
		33	N-86-10-05	1886	
		34?	N-86-10-08	1886	

MENLO PARK NOTEBOOKS, 1878–1882

The Menlo Park Notebooks cover the period 1878 to 1882. Some of the books also contain entries from 1883, 1884, and 1885. These books are the principal sources for documenting the invention and development of Edison's system of electric lighting and power. They also contain much material on the telephone, as well as scattered entries detailing work on electric railways, batteries, ore separation, telegraphy, and various other technologies. The books generated during the first year of work on the electric light are primarily by Edison, Charles Batchelor, and Francis Upton. The names of other laboratory assistants frequently appear as witnesses. As the staff of the laboratory expanded, many other individuals began making entries in the notebooks.

The Menlo Park notebooks are numbered from 1 to 249. Approximately 70 books are missing from the set. Pasted onto the inside front cover of many of the Menlo Park notebooks is a bookplate with the inscription: "Library of the Board of Patent Control, 120 Broadway, New York. May 1, 1896." The words "General Electric" have been crossed out and the following notation added in red ink: "From Library 44 Broad St., N.Y.C." Many of these notebooks also contain labels tipped into various pages, describing the experiments that follow. These labels often enumerate patents relating to these entries or suggest that the entries were "unimportant" for defending patent claims.

All of the extant notebooks have been filmed with the exception of a few books that contain mathematical calculations without accompanying notes and drawings or that relate to routine shipping transactions. The books appear on the microfilm in the order of their Menlo Park number.

The following notebooks have not been filmed:

Notebook #75 [N-80-06-10]	(1880)
Notebook #136 [N-80-08-11]	(1880)
Notebook #142 [N-80-11-27]	(1880)
Notebook #151 [N-80-06-01]	(1880)
Notebook #161 [N-81-10-18]	(1881-1882)
Unnumbered notebook, N-80-01-16	(1880)
Unnumbered notebook, N-81-04-02	(1881-1882)

Assigning Dates and Authors to Menlo Park Notebooks

Initially, it was the practice for members of the laboratory staff to sign and date each notebook entry. However, as the press of work and the size of the staff increased, Edison and his associates sometimes neglected to sign and date their work. As a result, there are many notebooks containing only a few dated entries, and some of the books are entirely undated. There are several methods of assigning dates or date ranges to undated notebook entries. Sometimes two members of the staff recorded the same set of experiments in separate notebooks. In such cases, an undated set of notes in one book may be dated in the other book. Date ranges can be assigned to other undated entries by a careful examination of dated entries on the pages preceding and following the undated entry. Moreover, it is usually possible to determine the earliest date that a particular notebook could have been used by examining the cover of the book. The earliest Menlo Park notebooks (November 1878-April 1879) all have blue-green covers. The covers of the later notebooks are a variety of colors, including dark red, light blue and black, dark blue and black, and green-orange. An analysis of the notebooks with dated entries reveals that books with similar covers were usually generated during the same time period. Thus, it is possible to conjecture that an undated notebook with a light blue-black cover dates from the period April-December 1880 and that a notebook with a dark blue-black cover dates from the period after January 1881.

One other source is invaluable for dating notebook entries from 1880. There are two Menlo Park Notebooks and six pocket notebooks that were used by Charles P. Mott, a member of the Menlo Park office staff, to record the daily activities of the laboratory between March 1880 and March 1881. Mott sometimes included references to specific notebooks and mentioned the names of individuals working on specific projects, thus allowing the attribution of authors and dates to entries that could otherwise only be conjectured.

For the early books, which are primarily by Edison, Charles Batchelor, and Francis Upton, it is usually possible for a careful researcher to distinguish writing and drawing styles in cases where an entry is unsigned or more than one person signed the entry. For the later books it is more difficult to attribute authorship, but the Mott journals can help the researcher become familiar with the writing and drawing styles of the various staff members.

A more extended discussions of these issues can be found in Robert Freidel and Paul Israel, <u>Edison's Electric Light: Biography of an Invention</u> (New Brunswick: Rutgers University Press, 1986), pp. 233-238.

Menlo Park Notebook #1 [N-78-11-28]

This notebook covers the period November 1878-July 1879. Most of the entries are by Edison, Charles Batchelor, and Francis Upton. There are also entries by George E. Carman and George Jackson. The names of Martin Force and John Ott appear occasionally as witnesses. Almost all of the material relates to experiments on electric lighting. Included are notes and drawings of lamps; notes on materials for filaments; drawings of devices for producing and testing filaments; notes, drawings, and calculations about generators; notes by Edison on gas use in San Francisco; and drawings of arc lamps. There are also notes on batteries made and tested, notes on carbon button tests, and notes and drawings of telephones. The book contains 274 numbered pages.

Blank pages not filmed: 240-241, 258-261, 270-273.

Missing page numbers: 264-265, 268-269.

M01

12 1/2

$$\begin{array}{r} 752 \\ \underline{45} \\ 3760 \\ \underline{3008} \\ 33840 \end{array}$$

7500

Nov 28 1878

TAE

San Fran uses 500,000,000 per year

if this was burned in burners

Consuming 5 feet per hour, ~~[illegible]~~

10 hours per day then

1 burner 20 days per 1000

or 500 burners, 20 days,

1,000,000 feet would [illegible] 1000

burners, or 500 000 jets would

burn up the entire [illegible]

20 days, or 250 000 in 40

125 000 in 80. 62,500. in 160,

31,250. burners in 320 days,

[illegible] I think there is 90.000

burners in use,

~~10~~ ~~500~~ 5) 1500,000 day

6) 300,000

50

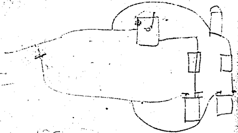
200,000

2 300 100,000

100

M01

752
45
3760
3008
33,840



750
5
3750
3750
7500

O Book Nov 28 1878
TAE

Sautrian uses 500,000,000 per year

if this was burned in burners

Consuming 5 feet per hour, ~~ea~~

10 hours per day then

1 burner

burner in ...

~~10~~ 5) 1,500,000

6) 300,000

50

2 ... 100,000

100

15/188
128 8/15
60
720
32
752

15/480
32

Nov 28. 1878.

1000)1500000.
150,000.
9
1,350,000

160000
1480000

170.000,
TCR

10

200
100 ton 1 hour
50 2
25 4
12½ 8

25

500
10 stations 5 each

170 tons.
5
850
80
93

170
4
680.

100
1000

12 1

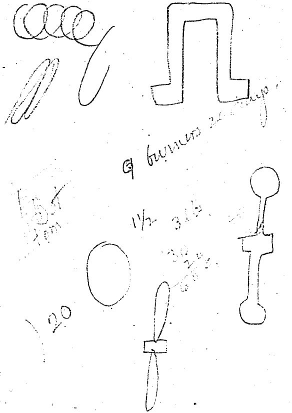
9/500 000.000
56,666

5 100
56
9
514

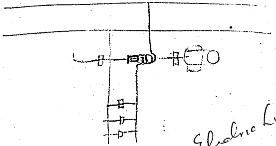
50 000
16
300,000

Nov 28. 1878

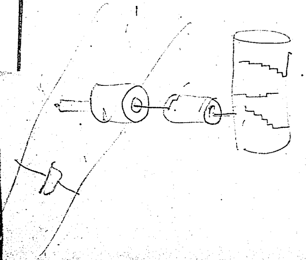
TAE



Nov 30 1878
TA Edison

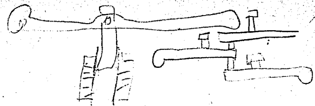


Electric Light Meter

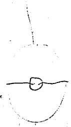


8

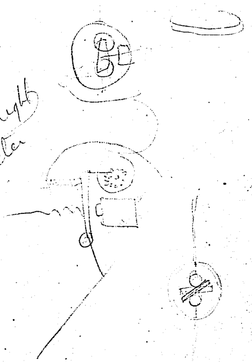
9



Nov 29 1878
TA Edison



Electric light
Meter



10

11

Nov 29, 78

See Pat. 242,901 & Pat. 222,112 W.J.H.

Nov 29, 78

T A Edison

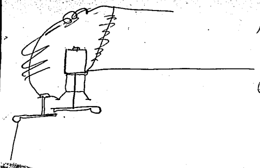
See Pat. 242,901 & Pat. 222,112

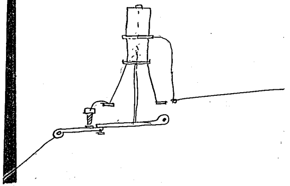
W.J.H

Nov 29 78

T.A.E

Chas Batchelor





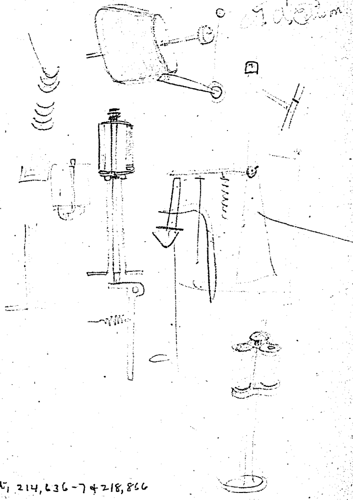
100.

1	1
2	.50
4	25
8	$12\frac{1}{2}$
16	$6\frac{1}{4}$

17

Dec 6 1878. 18

T A Edison

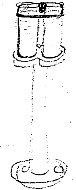


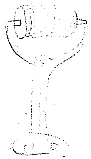
Pat, 214,636-7 & 218,866

18

Dec 6 1876

TAE





See Pat. 214,636-7- + 218,866

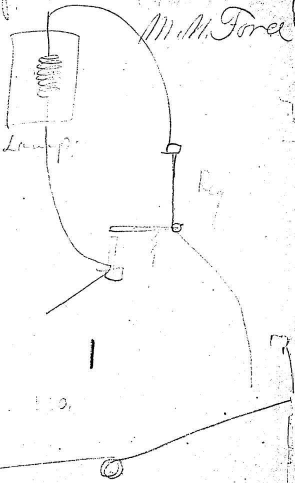
18

Electric Light

Dec 6 1878

M. N. Force

Made by Geo Carman



110.

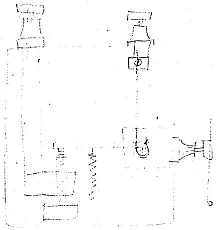
See Pats 214,636 – 214,637 – 218,866 N.J.H.

Electric Light

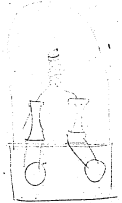
Dec 7 1878 Chas Batchelor

Make by Geo Jackson

2



2



See Pats 214,636 – 214,637 – 218,866 W.J.H.

Dec 9th 1878 28

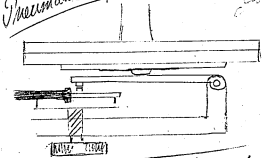
Electric Light

Pneumatic Regulator

Chas Batchelor

John Ott

TAE



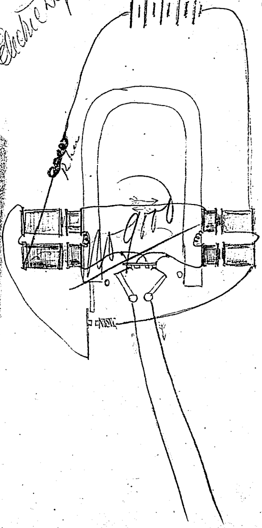
Shorten the Chamber & put lever in place of Spring

See Pats 214.636 – 214,637 – 218.866 W.J.H

Electric Light

Dec 15 1878

TAE



see Pat- # 218,166 W.J.H

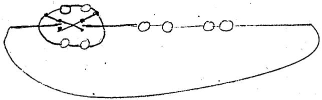
26

Dec 15 1878 27

Fork Magnets

Chas Batchelor

TAE

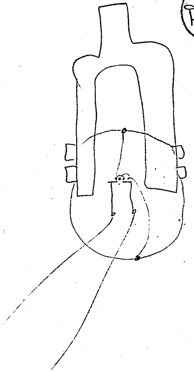


See Pat. 218,166 W.J.H.

21 21

29

DEC 15 1878

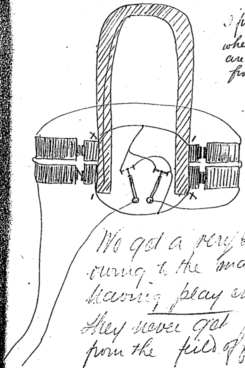


See Pat. 218,166 W.J.H.

Electric Light

Dec 15th 1878
Chas Batchelor
TAE

31



I find most current when induction magnet are connected together from X to X & 1 to 1

We got a very slight current owing to the magnets not having play enough they never got far enough away from the field of force

We want more amplitude of vib. in fork

See Pat 219,166 WJH

With plain fork with 9 cell OTH
we get on end of fork

$24\frac{1}{2}$ inches of fork	Vibration	·10 of inch	
17	"	·06	—
11		·04 of inch	

With weights when tuned up.

$24\frac{1}{2}$ inches	Vibration	·14 of inch
17 —	—	·07
11 —	—	·045

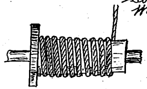
see Bat 218, 166 W.J.H

Electric Light

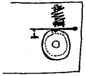
Dec 14 1878
Chas Batchelor

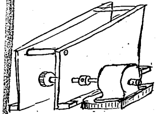
Train of Gears
generator turns 600
weight to fall 10 feet
size of drum about 3.85
in order to make 10 feet
drop in 10 turns

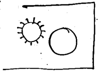
Pin on drum to connect
circuit and on turning
ten times open again
Large handle for winding
Weight up again

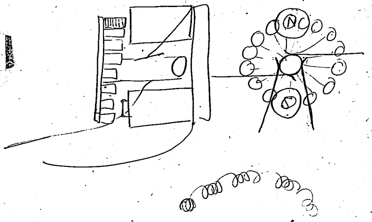


TAE









TM

Electric Light

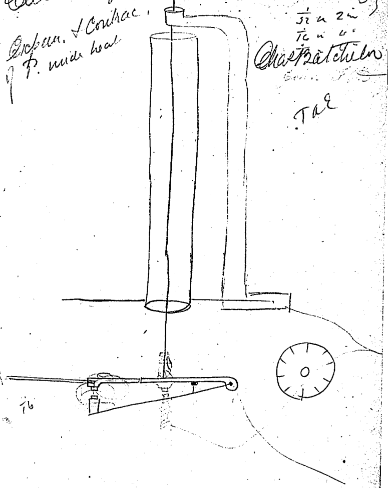
Dec 18.1878

Expan. & Contrac.
of P. under heat

$\frac{1}{32}$ a 2 in
$\frac{1}{16}$ " 4"

Chas Batchelor

TAE

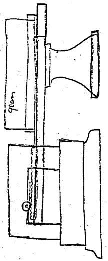


Electric Light

Dec 18th 1878

Chas Batchelor

+ CR

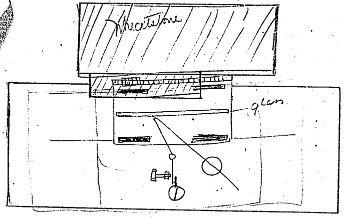


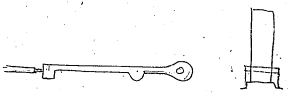
$\frac{3}{32}$ $\frac{9}{96} = \frac{2.25}{24}$

Instrument for recording Wheatstone [illegible] spiral $\frac{1}{32}$ then 3 lines for $\frac{3}{32}$

" 24 " $2\frac{1}{4}$ for $\frac{3}{32}$

Chas Batchelor
John Ott
TAE



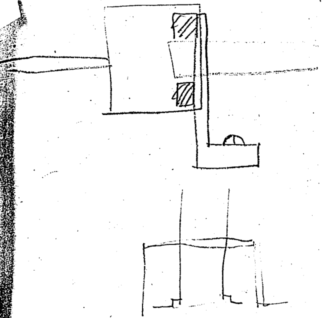


Magneto Electric Machines

Dec 26 1878

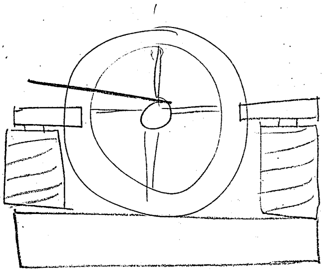
Chas Batchelor

TAE



Magneto Electric Machine Dec 26th 1878 14

Chas Batchelor
TAE

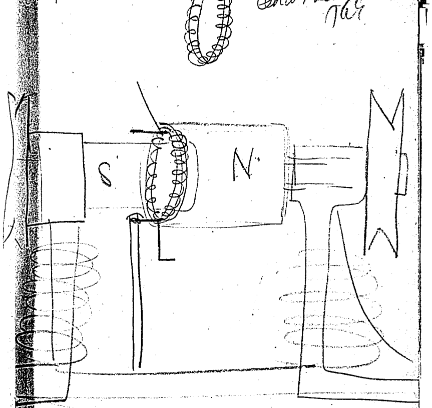


Magneto Electric Machine

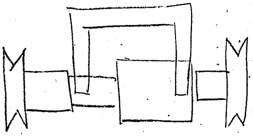
Dec 26th 1878

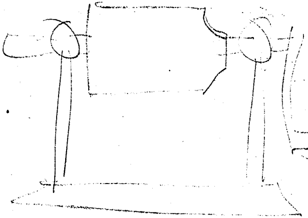
Chas Batchelor

TAE



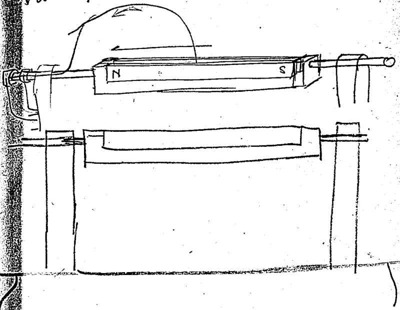
Jar

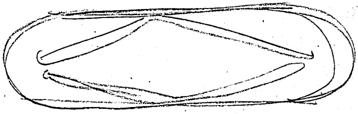


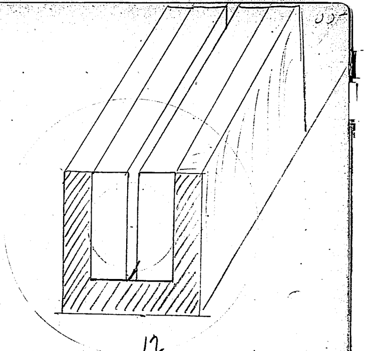


Faraday Dust

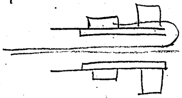
FaE

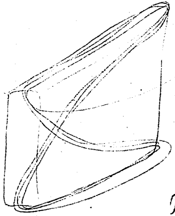




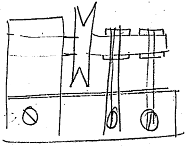


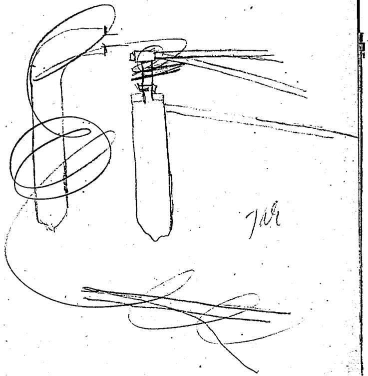
1 piece 12
1 " 4

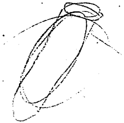




JAE







Johnson Matthey
Iridium 17·42 per Oz
Rhodium 30 6d per Oz

Aluminium did not melt in the H flame and in the O.H seemed only to oxydize without melting. Came up to incandescence without melting. When the blast of O was brought in contact it melted

Magnesium
Oxidises too easily

Manganese.
Cannot tell anything about it.

Boron does not melt.

Cobalt. brittle seems to stay at white heat. Melts when oxydizing at white heat. The [illegible]. Breaks to pieces under the hammer.

Nickel changes very little at white heat except to oxydize. Does not melt light brilliant. Can be pounded though cracks appear from non annealing. (As infusible as Pt) Greatest difficulty in melting it seemed to melt at about the same temperature as Pt. E

See page 66

Cerium ~~does~~ seems not changes Slightly fused. The fusion probably due to impurities of silica. E.

[illegible] oxydizes

Iron went immediately

Silicium seems to volatilize about [illegible] when a certain temp-erature [illegible]

Silicate of nickel. ~~Does~~
Nickel Silicium placed together in flame O + H. Melted but not very readily. The mass was magnetic.

Rutile oxide of Titanium fused. Good conducting very [illegible] [illegible] when [illegible] [illegible] ~~[illegible]~~ 17 Ohms

See Pat. 219,628

The button was extremely hard and green when broken

Resistance of a wire 1 ft long 1 mil in diameter 75.78 Matthiessen

Resistance of wire 1 Metre long 1 mm in diam. 1.071 Nickel annealed. This is about 1/3 greater than Pt.

Wright Vol. 13 Amer. Journ. Sci. P. 52 obtained a thin film in a tube which in transmitted light was gray or brownish gray. The removal of O was not complete

The button under the microscope was insulated by what seemed like lime. no metallic color be discovered

Lasimeter No. 1.
Patrick & Carter

29	R	100
25	L	50
20	L	25
15	L	0
10	L	100
5	L	170

10

Off

~~10~~ 5	R	+270
10	R	270
15	R	280
20	R	280
25		200
30		1.00
35		125
40		150
45	Off scale	

70

40 L — off

35 L — off

~~Stuck [illegible]~~
shaken the

0 Rt 0

25 — off

20 — off

15 End

10 — End

5 — End

6 — End

71

95 — L — True

90 — 125

85 — 125

80 — 0

Changing

68 + 125

62 + 180

50 R — 170
45 L — 150
40 L — 140
35 L — 140
30 L — 140
25 L — 140
20 L — 135
15 L — 135
10 L — 130
5 L — 120

0 L — 120
95 L — 115
90 L — 115
85 L — 115
80 L — 110
75 L — 105
70 L — 100
65 L — 50
60 L — 35
50 L + 45

50	L	+140	
45	L	+230	
40	L off	+360	
45	R	+360	
50	R	+355	5
55	R	+345	10
60	R	+345	0
65	R	+340	5
~~70~~	~~R~~	+337	8
75	R	+335	2
80	R	335	0

85	R	335	0
90	R	335	0
95	R	335	0
0		331	0
5		335	0
10	R	+300	35
15	R	+285	15
20	R	+250	35
25	R	+208	50
30	R	170	30

Nov 1.

35 R + 130

40 R + 45

45 R R — 45

50 R — 140

55 R — 225

60 R — 300

Rasimeter made in shop 50 Divisions

~~40 R~~ 30 hms

30 R — 150

25 L — 132

20 L — 100

15 L — 75

10 L — 55

5 L — 40

0 L — 30

45 L

40 L — 30

— 20

78

35 L — 5
30 L + 5
25 L + 40
20 L + 80
15 L + 130
10 L + 200
5 L + 305
0 L off

45

79

0	L	off
5	R	"
10	R	"
15	R	"
20	R	"
25	off	
30	off	
35	off	
40	off	
45	360	
50	335	

~~0~~

5 + 330
10 295
15 235

20 R 145

25 R 130

30 R - 175

32 - 250

33 - 275

34 - 325

Tole same

~~R~~ 7 ½ L just off the scale

20 R

25

30

15 with next shot appears

45 350

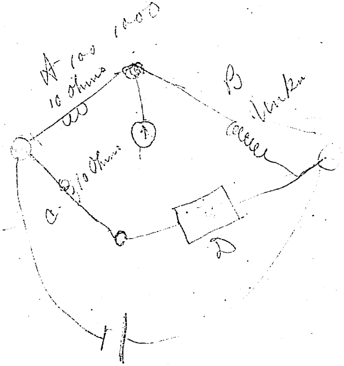
0 270

5

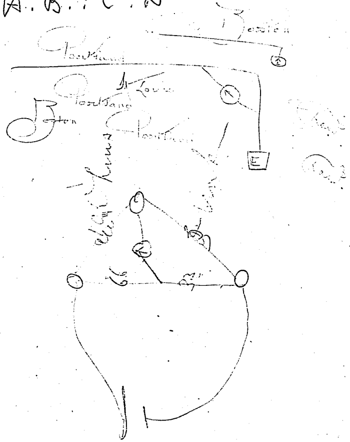
10 150

15 R 100

25 -- 30



A : B :: C : D



88

No. 1.

~~One the~~ Ohe turn

flag in the scene.

from 19 Ohms to

1/4 ohm ... button

No. 2 10 Ohms resistance

95 R	320	
90 L	290	30
85 L	4 235	45
		45
80 L	170	
		30
70 L	60	
		55
65 L	5	
		65
60	-60	
		95
55	-155	
		95
50	-250	
		85
45	-335	

the O f f

50 R	−320	
55 R	−250	70
60 R	−190	60
65 R	−120	70
70 R	−70	50
75 R	−15	55
80 R	+42	57
85 R	+97	55
90 R	+142	55
95 R	+210	68
0	+265	55
5	+320	

No. 1 New carbons

11 Ohms to 1 Ohm

tested on one Ohm and found that the slightest change of the screw would throw the spot off the scale.

very little play in screw and none when sensitive at sixth of Ohm

About 80 divisions play when the R = 4 Ohms and Galva. doubly shunted.

No. 2

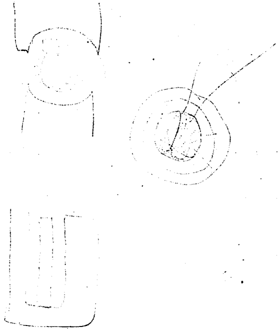
80 divisions play 9 Ohms
Galvanometer shunted

from 17 Ohms to .7 Ohm
60 divisions + 1 Ohm

Instrument made
has very little play
and very sensitive

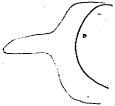
No 3 no play
very good

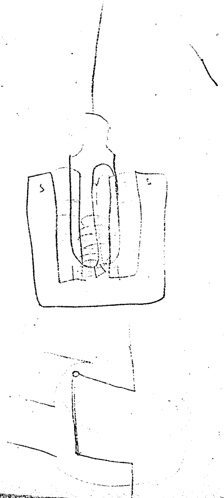
~~the~~ Tried again with a
shunt on Gal and found
80 divisions back lash



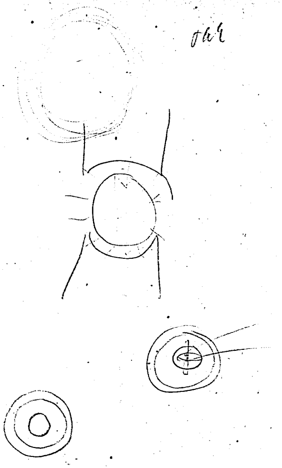
91

Pages 90 to 97 incl. "Dynamo Sketches."

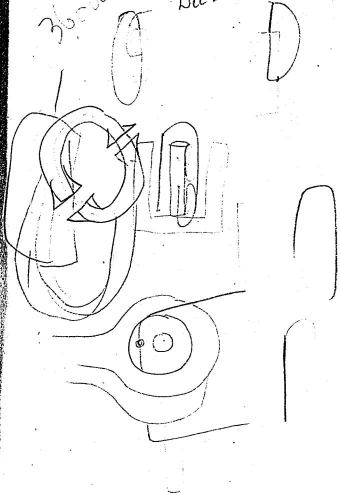




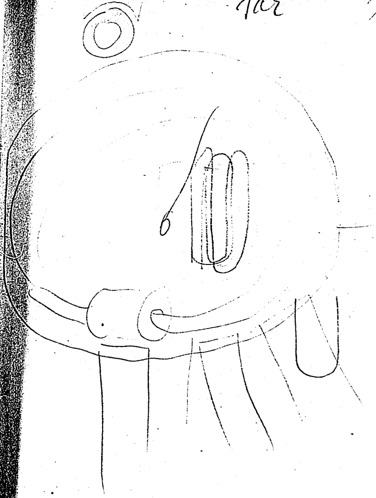
Ohr



Dec 25 1898



Tae



Calory per gramme
Ra-Cl per gram .198547

log $\bar{1}.297798$

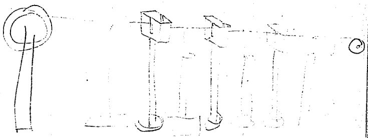
7000 log 3.845098

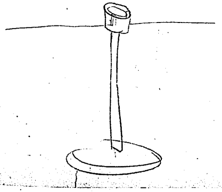
3.14289

100

TAE 101

Wire drawing, While heating Wire. Page 101.





11.

8

8

24
8
192

60

60

60

192) 3360 (16
192
1440

24 56

$\frac{8 \times 24 \times 38}{60 \times 82}$

10 13

240
24
160

$\frac{8}{13}$

8

36 on shaft

42

0

$\frac{24}{60}$

$\frac{36 \times 30 \times 24 \times 8}{11 \times 42 \times 52 \times 60}$

180
8
1360

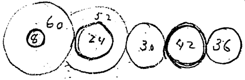
$\frac{36 \times 30 \times 8}{11 \times 42}$

6

7

$\frac{1360}{77}$

77) 1360 (17.2
77
590
539
210



~~824~~

8 X 24 X 36

8 X ~~60~~ X 52

~~24~~ X ~~36~~

63 63

9)160 (17
9
70

~~44~~ 7 13 ~~10~~ 5

~~42~~ X ~~52~~ X ~~60~~ ~~300~~

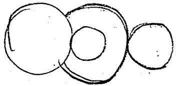
~~36~~ X ~~20~~ X 24 X ~~8~~

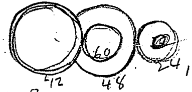
~~16~~ 3 4

35
13
105
35
24)455 (18
24
215
193
220

8X36
288

106





8

8

8

$$\begin{array}{r} 36 \\ 36 \\ 60\overline{)396} \\ \hline 66 \end{array}$$

107

8
2

33 48

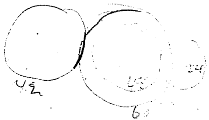
11

24 48 60 42

$$\frac{8 \times \overset{13}{\cancel{60}} \times \cancel{40}}{\cancel{60} \times \cancel{30}}$$

~~30~~
10

$$\begin{array}{r} 13 \\ 8 \\ \hline 104 \end{array}$$



No. 25 wire

2.72 Ohms

132 turns

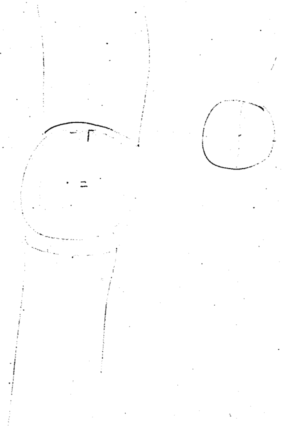
132) 2.72 (.02
2621
80

500
272
2) 228
114

132
114
18

12
12
132

12
8
96



100
12

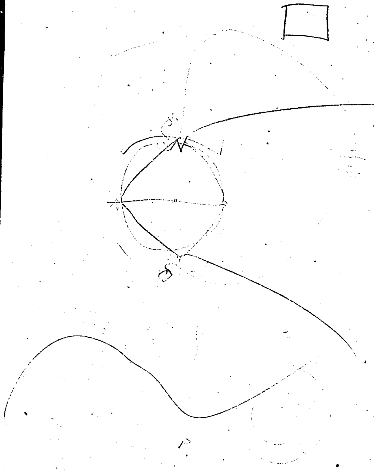
1047
3
.131
1100
131
.131
144.100

288 inche

28.8
14.4
7.2

1100

~~200~~
200°
62°
138°
138°
2760
~~1380~~
5520°



114

+	20	Ohms 2½ No 30
	10	Ohms
	10	Ohms
	5	Ohms 2 spools No 25
2	of 2	Ohms 1 spool No 2
	2	Ohms
	1	Ohm 1 spool No 20
	.5	
	.2	
	.2	
	.1	

115

No. 30 Wire

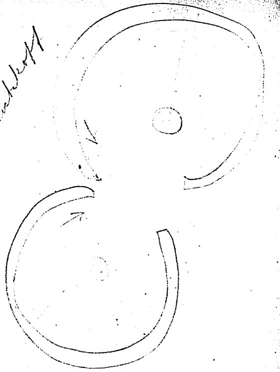
3 spools 20 Ohms

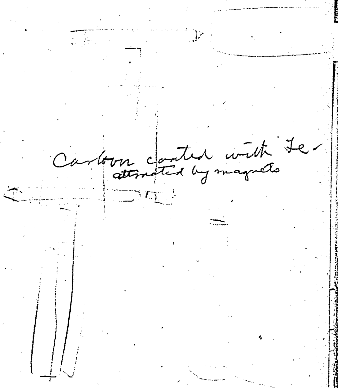
~~No. 24~~

5 Ohms 20

2 Ohm 1 spool No 23

Curved Jablochkoff

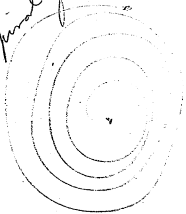




Carbon coated with Fe - attracted by magnets

TAE

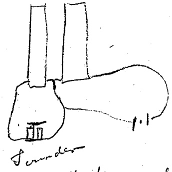
Spiral Jablochkoff



March 12

The discharge from a magnet measured

A sounder was placed thus

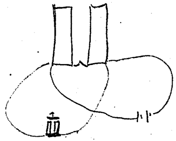


A ~~double~~ click could be heard when the current was taken off

TAE

2end method

TAE



Double clicks could be heard
when current taken off

3rd method

A duplex point was used
to break the main circuit and
the discharge thrown through
the sounder

Results when no armature
was on the magnet the dis-
charge was ~~very~~ stronger
~~and~~ sharper and of shorter

124

ter duration than when the armature was on.

125

Pages 125 to 153 incl. "No importance."

For coses 4.03 Diam 90 inch long
677 ft of No 8 wire =
" 11 Birm. gauge
= 0.45 ohms

314
5375
942
1570
16662
6.
99972

403
314
1612
404
1209
12.6552
90
1139.50

128 90000 7.03
896
400
256
144

14) 90000 643
84
60
40

1265
703
3795

643
314
2572
643

88550
12 889295
1500 6770 .45 49
7700 12

1265
643
3795
5060
7590
12) 8133.95 = 677

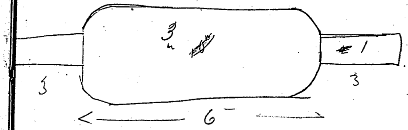
741929
12) 2019.02 = 168.
81
99
30

677) 15000
1354
146

93
93

lbs.

2
2
2
2
2
2
2
2
2
2
2
2
2
2
2
4
2
4


3"
1
3
3
6

63 m 10 sec 10

1 lb at 10 inches

678
5
3390

10
3.14
12 31.4
2.6

381
831
381
1143
11711

1/2 lb.

63
6
378
5
1890

30

20
3.14
6.28
2
12.56

1256

127
3
381

3.14
40
12 125.6
10.45
3
31.2

20 inches

40 inches

20

12 | 60

5

~~120~~

10 feet

3

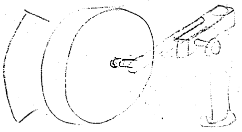
30 foot lbs

381

30

10,430

TAK



9 1

20 inches radius
40 inches diametre

40
3.14

$\frac{\cancel{40}^{10} \times 3.14 \times 3 \times 381}{\cancel{12}\ \cancel{4}}$

~~381~~
~~3.14~~

381
3.14
1524
381
1043
10,963.4

10,963.

Batch 10.963 ft. lbs.
20 seconds Test

Francis 16.046
10 Seconds 15.225

Martin 14.100. ft.
20 Sec -

Geo Carman
14.106 ft lbs
20 Sec

Albert Swanson 17.191
15.750

Times: 15.759 14.445

97

6

582

291

3 X 18.5 X 2 X 3.14 X 582

12

4

291

3

873.

18.5

4365

6904

873

16.070,5

18.5

2

37.0

3

12 | 111.

9 1/4

18.5

2

9 2/5

3

27.75

1.97

19425

24975

2611.75

6

16.146

5 . 1/2 .

171
5
855
85
940
5
4700
3
00
14.1

27.5
171
27
189
275
4617.0
4697

28.15
171
2815
19705
2815
4813.65

11.25 Radius, Diam 22.50

Rev. 171

Weight 5 20 ozs 22.50 / 12 / 67.5 / 5.63

lb. oz. lbs.
5 X 5.5 = 27.5 X 171 =

4697 X 3 = 14091

lb. oz.
5 X 5.63 = 28.15 X 171

4813 X 3 = 14439

Geo Carman

Weight 5

Revolution 171

Radius 11 . = diam 22

22 .
3
12/66
5.5
5
27.5
171
275
1925
2750
4702.5
3
14106

5.5

Swanson
Rev: 210
Height 5
Radius ~~10.5~~ - ~~19~~ 20

$\frac{20}{3}$ $\cancel{19}\ 3$
12|60 12|57 4.75
3
210
1050
5
5250
7
15750

Knesi

191 Rev.

11 Rads 22 Iran

5 ll.

22
12/66
3 5
5
27.5
191
275
2475
2475
5.2 5 2.5
3
157 57

5.5
191
955
955
7050
5
5250
3
1575
0

Rhus

21.4

9.m Rasis - 18 Dram

5 h

3
$\sqrt{54}$
4.5

21.4
85.6
1.07
9.63
5
4815
3
14.445

Chwanoos

Height 5

Rev. 191

Radius 12 = Diam 24

3

10 / 72

146

191

1146

5

5730

3

17.191

Weight

Rev. 203

Radius 10 —

5

20
2
10 | 60
5
203
1015
5
5075
3
15225

154

This battery has now been ~~shortcircuited~~ put on 100 ohms 13 hours out of 48 hours —
We now connected to Bergmann bell on 100 ohms and

May 11	11 AM	worked well
May 11	6 PM	worked, OK
May 12	7 am	Worked well
" "	1 PM	worked OK
" "	8 PM	All right
13	8 am	all right
13	6 pm	OK

May 9th 1879 155

Call Battery

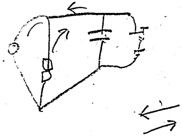
Chas Batchelor
M. N. Force

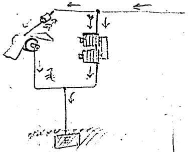
Tests on 100 ohms,
10 Couple Leclanche - Galv Shunted

Put on	Deflec.	Taken off	Deflec	Total time on	Off
11 AM	67	12 "	65	1 hour	1-30
1-30 PM	67	3:10	60	2-40	:50
4 PM	65	7'50	50	6-30	2.30
10 20 PM	53	11 PM	49	7.10	
8-30 AM	50	10 AM	35	8.40	
11 AM	41	12 n	32	9	
12-30 PM	35	1.50	30	11	
2.35 PM	33	3.35	26	12	
10.15 AM	42	11-15	27	13	

See other side

116





Birkey 117

May 10th 1879

M. M. Force

Call Battery

No 2. Tests on 100 Ohms

10 Couple Leclanche Gas Electric

1/2 Carbon 1/2 Hyperoxide Mg

Put on	Deflec	Taken off	Deflec	Total time on	Off
2.23 P.M	57	2.35	50	4 m	1 hour
3.35	52	3.45	45	0-10	1
4.45	50	4.55	43	0-10	17
10.3 AM	55	10.13	36	-10	3
1 PM	47	1 10	34	<10	76
13th May 5 p.m.	41	9 PM	15	4.00	
14th May 12 noon	rings bell	through	200	Ohms	OK

Batteries May 15th 1899.

No 3

100 ohms resistance always

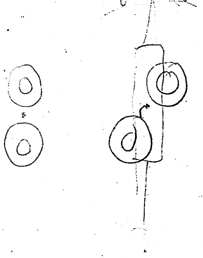
13 couples Zinc + Carbon

layer of NH_4HCl 1/16 thick

2 thicknesses of blotting paper saturated with NH_4HCl

Time	Date	Deflec	[illegible]	Total time on	Total off	Remarks
2.33	15th May	68°	56			
3 55		63	54			
4 35	—	58 —	— —	—	— — —	Taken off by T.K.
6 PM	rings bell	perfectly	through	200	ohms	(Batteries)
8 PM	" "	" "				
10 "	"	" "	"	300	"	G.E.C
7.30 AM	16th May	" "	"	400	"	G.E.C
2 "				400		M.N.F.
11.30 PM		weak	— — =	400	"	G.E.C
1.30 AM	17th will	not ring	through	400	"	G.E.C
1.30 "	very	good	on	300	"	— —
3.15 "	"		"	800	"	— —
5.40 "	rings	through		400		
7.30	"	—		400		
	"	"		400		——
8 PM	"	"		40[illegible]		

See page 175



May 15 1879

Batteries No 4

10 candles Zinc & [illegible] with layer of [illegible] & [illegible] solution & [illegible] suspension about 1/32 in thick on carbon then 6 sheets blotting paper soaked in sol Sal Ammoniac

Put on

10 PM	rings bell through	400	ohms perfectly	GEC
16th May 7.30 AM	" " "	400	"	GEC
2 PM	rings bell perfectly Through	400	ohms	M.N.A.
11.30	" " weakly "	400	ohms	GEC
17th May 1.30 AM	" very weak "	400	"	GEC
3.45 "	" " " "	400	"	" "
6 "	rings bell through	400		" "
8 "	" " "	400		" "
10 AM	" " "	400		
5 PM	" " "	400		

18th May 4 PM. OK on 400 ohms.

See page 179.

GEC

Battery No 5 May 17-79

11 cups Zinc & Carbon with 6 sheets Blotting Paper soaked in Saturated Solution Muriate Ammonia and 6 inches square [illegible]

[illegible]

4.20 AM May [illegible]

[illegible] through [illegible] no resistance [illegible] not strong — GEC

[illegible] A M amp through 600 ohms [illegible]

8 30 " " " "

10 AM " " " " " CB

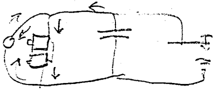
[illegible]

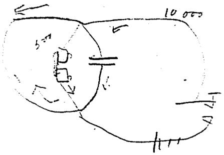
taken off 4.30 PM May 17 and ~~sent~~ taken to Bergmann & Co N.Y. By TAE & CB..

Brought Back and Put on 28th at 5.30 PM.

[illegible] 1 PM on 29th.

GEC





No 6 Battery MAY 17 79 [illegible]

Eleven Cross Carbon & Zinc onto [illegible] blotting paper soaked in Sulphuric acid 1 part to 12
GSC

5.30 PM O.K. on [illegible] 200 Ohms. GEC

May 18 4 PM OK on 400 ohms — CB.

May 19 12 PM O.K. on 1000 GEC

" 23 Ran on 100 Ohms after standing open for 4 days and will not ring Bell

C E Carman

Telephone May 17 1879

Chas Batchelor

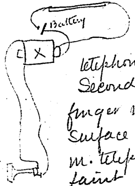
Made a button for transmitting of tal Sulphide of Copper.

It was just about one half as loud as our regular button

Its articulation was very perfect

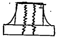
Its best talking was done when it measured 9 ohms resistance

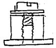
A piece of Sulphide of Copper measuring 37 ohms was put in primary circuit of coil X, and telephone receiver connected with Secondary. Scratching with finger nail or knocking on surface of Sulphide can be heard in telephone but exceedingly faint.



Domestic
Domestic

Do





Battery 3 — [illegible]

May 18th 4 pm. rings perfectly on 300 ohms

May 19th put on 100 ohms and closed every hour ~~50~~ 2 times at 5.30 p m

taken off at 6 am & put on again [illegible] 7 PM [illegible] 10 PM.

[illegible]

[illegible]

having rung the bell 3750 times

[illegible] 300 [illegible] put on

[illegible] through in every [illegible]

Started 7 [illegible] May 25th 1899

[illegible] Ohms resistance

[illegible]

[illegible] 12 [illegible]

[illegible] commenced at one [illegible]

30 [illegible] taken off [illegible] 7 pm

May 27th 9 am put on bell but it would not work it

- 198
145

3000.

$4\frac{1}{2}$

3

30

300

3 16.

Mac 3/4.

1	Mac 1/2	– LW $\frac{1}{4}$	– 30 lamps	16
2	$\frac{1}{4}$	– $\frac{1}{8}$	60	8
3	$.12\frac{1}{2}$	– .06	120	4
4	06	03	240	2
5	03	$01\frac{1}{2}$	480	1
6	$01\frac{1}{2}$	$07\frac{1}{2}$	960	$\frac{1}{2}$

continued from page 163

Battery No 4 May 19th

5.30 PM Put on clock going and
connected with main Shaft in Shop
made to ring 352 times per hour
through 100 Ohms — taken off
5 minutes

10 PM May 19th
ring through 300 Ohms

May 27 8.30 a.m. put on bell ringing
~~through~~ 100 ohms by shaft

Battery No 7 G E Carman

11 [illegible] [illegible] 6 [illegible]
[illegible] [illegible] [illegible] [illegible] [illegible] 1 part
[illegible] 3 parts [illegible] 1 30 PM
[illegible] [illegible] 752 [illegible] per hour
[illegible] through 700 ohms resistance
[illegible] [illegible]

Taken off 3.30 PM for ½ hour
and internal resistance
measured [illegible] to be .20 Ohms
put on at 4 P.M. [illegible] 6th
PM) started at 7 PM [illegible]

[illegible]

May 21
Started 7 AM
Run till 10 PM May 22nd 1879
started 7 AM — on 100 Ohms resistance.
run till 11 PM See Page 185

Rating [illegible] [illegible]

May 25th 1879

[illegible] [illegible] [illegible]
[illegible] [illegible] [illegible]
[illegible] soaked in Sol Sulph
℥ß to O¼ water
[illegible] [illegible] [illegible]
[illegible] [illegible]

[illegible] Carman

from Page 181 G. E. Carman

Battery No 7 — May 23rd 1879

Has run 21 hours 752 Str hour 15.792 Str G. E. Carman

Started on 100 Ohms resistance at 7 A.M. Chas Batchelor

Run on 400 Ohms =

Taken off 11 PM having run 14 hours total

running time — — — — 36 hours

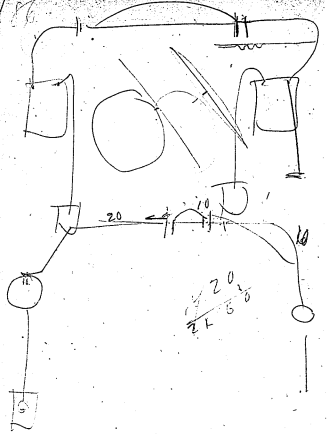
run May 24 — — — — 9 hours

45 hours

Making 752 strokes per hour makes 33.840 strokes

Saturday 5 P.M.

May 26 Monday Put on at 9. A.M.



May 29th 1879

Battery No 9

Chas Batchelor

9 couples: Carbon & Zinc
6 papers wet with Chl Ammon

Put on at 1 PM May 29 1879 and it rings through 100 ohms good but it wont through 200.

taken off ~~3~~ 4 PM called 2150 times

Total time Made	on	off	calls	total calls
3 hours				2150

Bat: No 90 Batchelor 16

Put on 4 pm 29 May 1879

rings through 100 ohms

Battery G. S. Cannon
No 11 May 31st 1879.

9 couples Carbon & Zincs with
Six Layers Paper in Sol Sal Ammon
and water Equal parts
½ inch Smaller than Carbon plate
runs through 100 Ohms Resistance

June 2 10 AM rings now only on
short circuit

G E Carman

No 12 Battery May 31 1879

9 Lamps carbon & zinc taken
from No 5 and cleaned
set up and rings through
300 Ohms - formerly rang through
600 " weakly

June 2nd 10AM rings weakly on 200 ohms

G E Carman

No 13 Battery May 31st 1879.

6 cells Carbon & Zinc Strips in Solution Sal Ammoniac And water Equal parts rings through 250 ohms resistance

June 2nd wont ring owing to corroding of copper at point of contact of wires

Make another —

— G. E. Carman

Battery No 14 May 21 '87

Plain Zinc & Carbon

Carbon soaked 14 hours in
Electropoion then washed and
boiled in parafine
Rings through 500 ohms resistance
at 3.30 PM through 400 at 4.30 PM

George
Make a battery of Carbon and Zinc with 6 sheets of paper between. Amalg.
4 Sheets next the carbon to be soaked in solution of 1 part ordinary bichromate solution and 1½ parts water
2 Sheets next the Zinc soaked in weak solution of Sulphuric acid & water

---

Make a battery of Carbon + Zinc and between them, put a layer $\frac{1}{32}$ thick of Sulphate of Mercury on the Carbon Then put 2 sheets paper soaked in Solution SO_3 (12-1)

Make bottle battery 10 cells like other one but weak solution of Bichromate in Amalgamate Zinc.

Make bottle battery 10 cells like above but weak solution SO_3 + ~~H_2~~ O
amalg Zinc

Make battery of 10 bottles of Zinc + ~~Carbon~~ Copper (no amalgamation) fill bottles with solution of Alum (concentrated)

Make up Sal amm ~~bottle~~ battery again making good connec. & paraffining them

---

Make ~~bottle~~ batt. of Amal Zinc an Carbon in Bichrom. + H_2O 12+1 and let Zincs stand in Hg at bottom of jar

---

Battery No 15 June 2d 1879

9 cells Carbon + Zinc (Carring).
6 sheets paper 4 soaked in Elect. 1
Water 1½ and 2 soaked in SO_3 very
weak

---

10 AM Rings at first through 100 ohms but
after five minutes it would ring in
short circuit

204

200

Battery 16 June 2d 1879

16 Bottles containing amal. Zincs and carbons in Solution of Bichromate 1 to 6 H_2O

10 AM June 2d 1879 rings through 800 ohms.

10 am June 10 1879 rings through 125 ohms

Battery No 17 June 2 1879

10 Bottles Amalg Zinc and Carbon in Solution of $SO_3 + H_2O$ in prop. of 12 - 1

10 AM June 2 1879
rings through 500 ohms good
11 AM June 10 1879 300 ohms good
" "

Battery No 18 Chas Batchelor June 2-79

10 Bottles Amal. Zinc and carbon in Electropoin 1 Part water 12 with Mercury in Bottom of bottles

3pm June rings through 400 ohms good

Made	goes through	Date	
10 AM	June 10	played out carbons corroded at connections	

Battery No 19 June 2 1879
Chas Batchelor

10 Bottles Zinc & Copper in
Saturated Solution alum
Rings through 200 ohms
3 pm. June 2.

Made	rings through	Date	
	200 ohm	June 2	3pm
June 9	1879 played out		

June 2 1879

Battery No 20

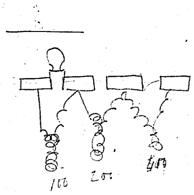
~~Chas Batchelor~~

Zinc & Carbon

No 6 1/32 Sulph Mercury and 2 sheets paper wet with SO_3 and [illegible] 12 to 1

Rings through 300 Ohms at 2 PM

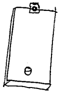
How long	rings through	on		
	300 ohms	15 ohm	2 pm	June 2
6 hours	500	15 ohm	8 pm	"
20 hours	400	15 ohm	10 AM	" 3

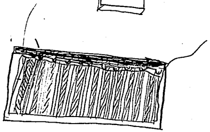


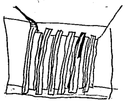
 Battery June 5th 1879

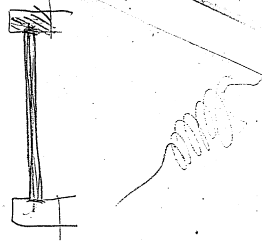
No 21. Same as no 20 6 made

Ring through 600 Ohms









1/2 diameter

1/4 section

4 times length or convolutions

16 times resistance

~~m~~ 1/100 16 times resistance

1/100

1/10'

$23 worth of wire

~~gives~~ take 1/10 of H.P to run

it it. $3.65 a year

$7.00 a year

2.30

$9.30

36.5	1,5623
23.	1.3617
23.	1.3617
	4.1857
$a = \frac{15330}{2}$	.3010
	$3\,)\,4,4867$
	1.4956

~~\$66~~ \$31.2

Let x = cost of wire
And y = cost of H. P. [illegible] for magnet

$y = \frac{a}{x^2}$

$yx^2 = a$

$y + x =$

$\frac{a}{x^2} + x = \text{min}$

y = \$36.5

x = \$23

$a = 15330$

$a(x^{-2})$

$-2a(x^{-3}) + 1 =$

$-ax^{-2} + 1 = 0$

$x^{-3} = \frac{1}{2a}$

$2a = x^3$

x = 31.20 max.

2cts. an hour

3.65
$\underline{\quad 2}$
$\$7.30$

$X = 823$

$\log X^2 = 2.7234$

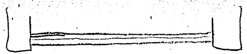
$\$73 = y \quad \log 2 = \underline{.3010}$

3.0244

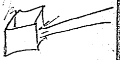
2.7234
$\underline{1.8633}$
4.5867

3.1244
$\underline{1.8633}$
4.8877
1.6292

~~$42.5 H.P at 2cts an hour~~
~~If ten magnets per H.P. will furnish~~
~~power enough with the magnet~~
~~of machine as now built $42.50~~
~~may be spent so as to bring~~
~~10% on a machine used~~
~~ten hours a day.~~



x = length
y = Diameter



Mass of iron axy^2

Cost iron bxy^2

Cost Cu. cxy

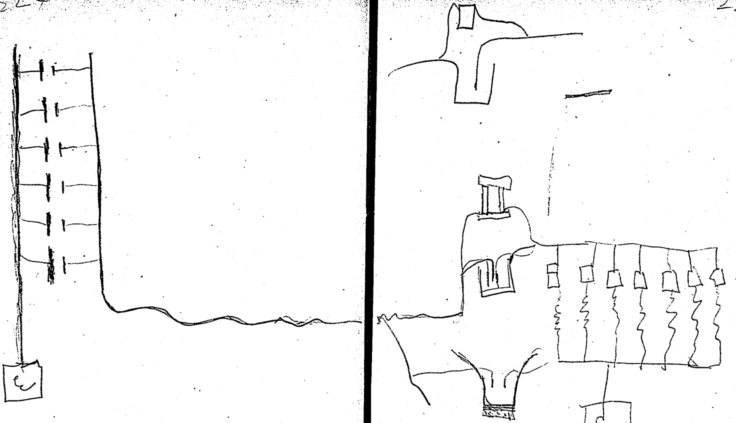
Efficiency Cu.

52
$\underline{30}$
1560

52
$\underline{156}$
364

$a\sqrt{x}\sqrt{y} \quad axy$

$(bxy^2 + cxy)$



The lamp

6 per H. P. July 8

1/2 ct an hour each for H. P. Cost including allowing for loss

cost and repairs of engine and boilers as delivered to Dynam machine

20 lights $100 dynamo

Gas $200

$150

$5
$5
$5
$15

1/2 ct a day

interest for capital

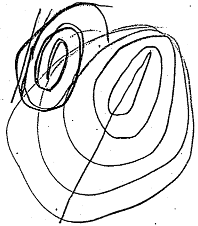
lamp Each light must burn on a average Thos

Suppose 1/2 Ohm machine compared to 1 thin

2 times the wire to make it ~~mag~~ equally efficient with same current

1/2 Ohm as compared with 1 Ohm

In the wire the same current has



4 Ohms same wire

4000 turns
4000 Ohms
4000
1 Current

4000 Ct

4 Ohms
1

~~1.18~~
1.19 Bridge
1.116 Slide

$$\frac{9}{56}$$

56) .9.0 (16
56
340
336
4

~~Illegible~~

magnets

24 hours a day

3.65 1ct an. hour
24
1460.
730
8760 $876

1 H. P. on magnet
~~[illegible]~~ cost of magnet

$\log 2x^2 = 3.0244$
876 2.9425
3 5,9669
1.7889
.3617

$97.50

$7.50

1/2 Ohm

2 times the wire same
current same no [illegible] just as effective
1/2 Expense

4 times the wire 2 times
the no ~~turns~~ 2 times the resis-
tance the same resistance
as at first.
1/2 the current twice
the strength
1/4 as expensive

~~2~~ Law

The economy of a magnet is directly proportional to the weight of Cu. on the magnet ~~if~~ the current be ~~arranged~~ ~~to~~ made ~~to~~ suit the resistance. For example a magnet of 1 Ohm consuming, ~~to~~ with 10 Webers of current on it, 4430 ft. lbs. of energy a minute and has strength of 10.

A magnet of 1/2 Ohm having the same no of convolutions, made by twice the wire, with the same

current on it, will have strength 10

Cost 2215 ft. lbs.

A magnet of two Ohms having twice the wire or twice the no. of convolutions will ~~to~~ ~~strength~~ with half the current have strength 10

cost 2215 ft lbs

Therefore it is better to buy a large sized wire as less cotton is bought and more Cu with the money!

234

$a = x\,y$

\$23

$x^2 = a$

$x = y$

23.   1.3617

36.50   1.5623

2.9240

1.4620

.1505

1.6125

\$29 can be expended

\$41 at 2 cts an hour

1 H.P. at 1 cts

1.4620

.5000

1.9620

\$91.6

237

Data ~~the large~~ The wire on the ~~large~~ magnet cost \$23. If 1/10 of a H.P ten hours a day are consumed on it, ~~be~~ how much can be expended in buying wire?

$x =$ cost of magnet

$y =$ cost of H.P. [illegible]

$y = \frac{a}{x}$ $x = \frac{a}{y}$

$x + y = \min$

$\frac{a}{y} + y = \min$

$-\frac{a}{y^2} + 1 = 0$

$-y^2 = a$ $x^2 = a$

$y^2 = a$ $x = y$

1890 1857 1842

1809.25

18085

1691

When the principal which will give interest enough to pay for the H.P. used, equals the cost of the wire then the maximum of economy will be obtained.

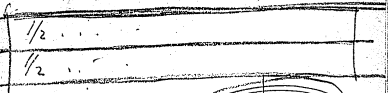
1/10 H.P. at 1 ct. an hour ten hours a day $29 can be expended

1/10 at 2 cts $41

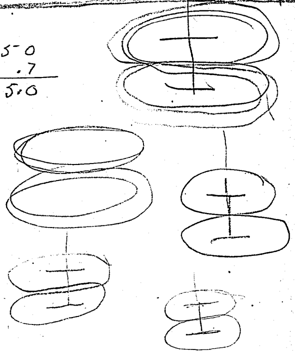
1 H.P. $91.60

15.05
84.95

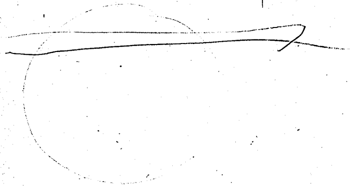
9 Ohms — 3 times the cond
1 Ohm — ~~1~~
1/2 — ~~1~~ 1.47
~~1~~/4 together — 1/2
1 Ohm — 100 convo
1/2 Ohm — 70.7 convo
1/4 — 50 convo
1/5 — ~~...~~

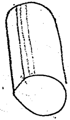


$$\begin{array}{r} 15.0 \\ .7 \\ \hline 10.5.0 \end{array}$$



1/2 Ohm how ~~many~~ much wire to weigh the same as 1 Ohm





1 as

0 35.94 No 12 wire
1 Ohm 1 pound
1/2 Ohm 1 pound

No. 19 wire
1.09 Ohms in lbs
140 feet in Ohm
No. 18 .59 Ohms in lb.
" 116 feet in 1/2 Ohm
No 23 wire

No. 23 wire

8.74 Ohms per lb.

60.5 feet per Ohm

No. 20 wire

2.77 Ohms per lb.

4 | 118.5 feet per Ohm

29.6 feet 1/4 Ohm

44.3
400
1772 00

1/2

.25

.5
.5
.25

141.3
6990
3495

1505
8495

1.5227

.9613

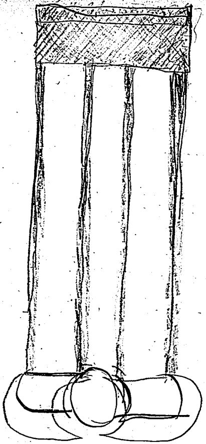
150 Volts

550 : 1700 :: 150
3501 / 103 Ohm

8.74
6.05

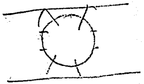
If an armature has 10 lbs. of Cu. on it and a resistance of 1 Ohm, with 100 convolutions

If 10 Ohms	316	Convolutions
5 Ohms	223	"
4 Ohms	200	"
2 "	141	"
1 "	100	"
1/2 "	71	
1/3 "	57.7	
1/4 "	50	
1/9 "	33	
1/16 "	25	
1/25 "	20	



How can I. ah

1 1,4 $\sqrt{2}$ $\dfrac{\sqrt{2}}{2}$

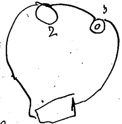


55)10500(190 Volts
55
500
495
50

~~550)1050~~

190
71
———
190
1330
———
1349.0 Volts

1 Ohm coil
5 Ohms Trans
2 Ohms battery   1/10 Ohm



8 Ohm

Current changes

Change in current   .7092
.2908

$\frac{1}{8} \times \frac{1}{80} = \frac{1}{640}$

$\frac{1}{8} \times \frac{1}{640} = \frac{1}{5120}$ 1954

2 Ohms   4312

$\frac{\cancel{2}}{9} \times \frac{1}{\cancel{810}} = \frac{1}{3645}$ 2700

405
9
———
3645

3 Ohms

$\frac{3}{10} \times \frac{1}{1000} = \frac{1}{3333}$ 3000

333

4 Ohms

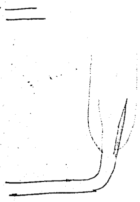
$\frac{\cancel{4}}{11} \times \frac{1}{\cancel{1210}} = \frac{1}{3327}$ 3080

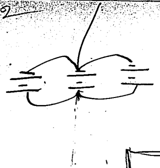
302.5
3025
———
3327

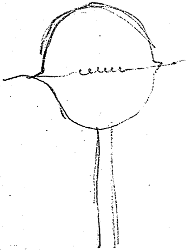
July 24th

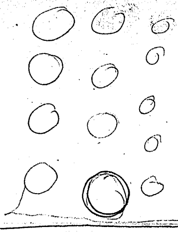
Whole line — 456
without Receivers — 320
Secondary & bell — 161
Tertiary — 350
Button (Chalk) — 7700

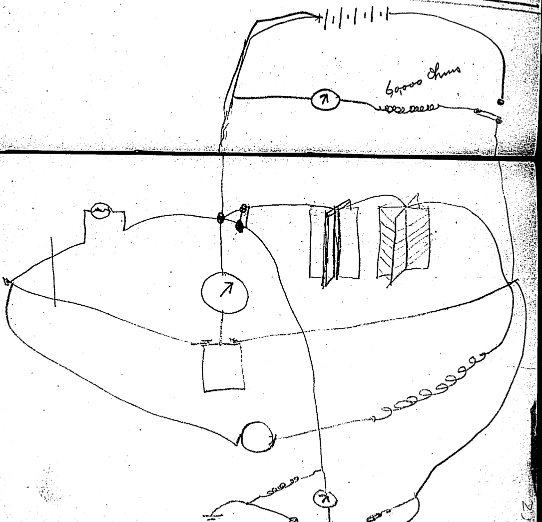
Secondary & Bell — 167

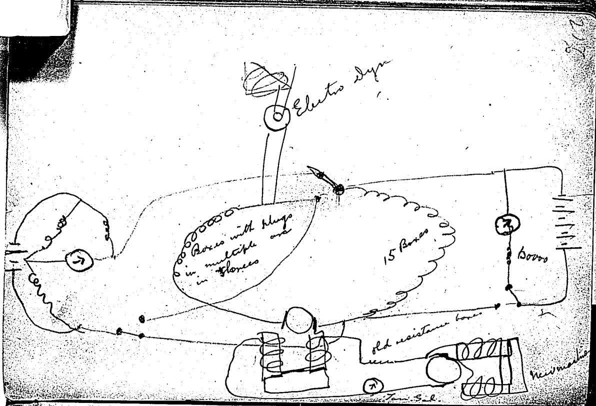


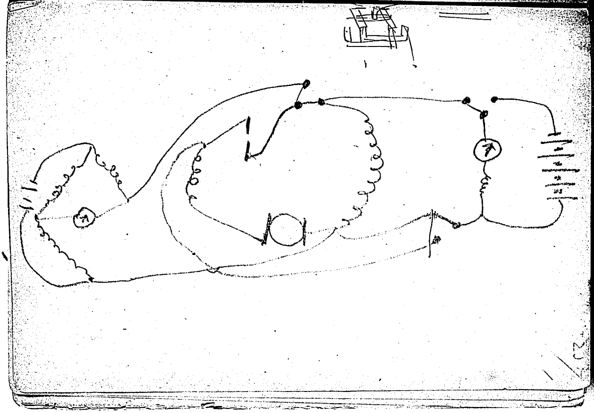


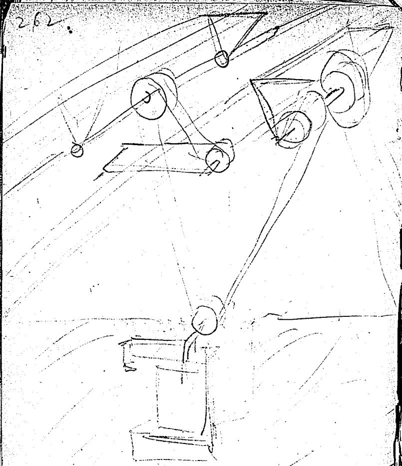




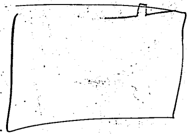

6000 ohms


Electro Dyn
Boxes with plugs
in multiple arc
in 8 places
15 Boxes
Boooo
old resistance boxes
new machine
Tan. Gal.





10000



10

1000000

100000

7)160(
22.857001
7)80
11.428
11.428

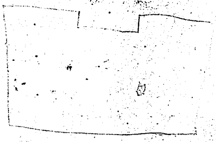
243)4000(1646
243
1570
1458
0120
72
1480 0.0001
1458

13)750(5769
65
100
91
90
78
120
117
30

19)750(39473
57
180
171
90
76
140
133
70

17)750(44117
68
70
68
20
17
30
17
130

1392 / 2652 20
2784



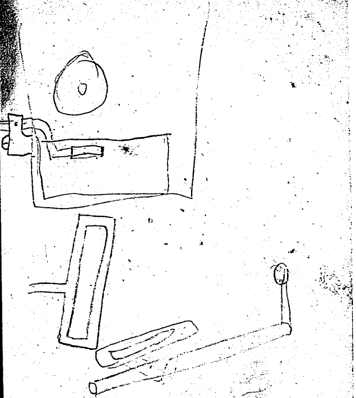
1 7/8   1 ½

15   3 ½

26

325
314
1300
375
12 : 318240 = 2652   975
78
62

10205
6
6170
52
12240
30600



Menlo Park Notebook #2 [N-78-11-22]

This notebook covers the period November 1878-June 1879. Most of the entries are by Charles Batchelor and Francis Upton. There are also entries by Edison and John Kruesi. The name of Martin Force appears occasionally as a witness. Almost all of the material relates to experiments on electric lighting. Included are notes and drawings of spiral filaments; tests of filaments brought to incandescence with batteries and generators; notes, drawings, and calculations about generators; drawings of a MacCleod gauge; and notes by Edison on another inventor's arc light patent. There are also drawings of the telephone, notes on chalk and carbon buttons, and a memorandum by Edison on Frank McLaughlin's prospecting trip to the Chandiere River in Canada. The book contains 262 numbered pages.

Blank pages not filmed: 48-49, 112-115, 118-131, 136-137, 158-201, 206-224, 227, 230-262.

Missing page numbers: 225-226.

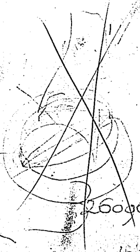
No 2. 12,
9,36
6,50
27,86

30,
27,86
2,14

16,
5
80,

3.

4.



2600600

Pt spiral

platinum outside
below the

Nov 22 1878
TA Edison
Chas Batchelor
P

Edison Lab

No 2

12,
9,36
8,60
27,86

30,
27,86
2,14

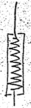
16,
5
80

3.

... May 1, 189?

Nov 22 1878
T A Edison
Chas Batchelor
P

Pt spiral



platinum outside
fused before the
Embedded Spiral

The platinum spiral was
imbedded in plaster paris
but this had so much water
that it cracked inside
Zirconium should be used
+ spiral heated so
Zirconium is under pressure

Electric Light Dec 5 1878

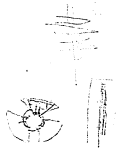
To be made immediately + shown [Batchelor]
on Friday afternoon –

2 old style lamps double spiral
square

1 Lamp (long spiral) about No 6
springs

2 Lamps new pattern.

Get some platina wire sme for
springs



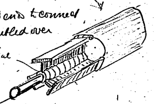
Electric Light Dec 4th 1878

Chas Batchelor

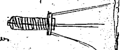
Machine for filling spirals with chalk or other insulator

Spirals must be made with equal numbers of threads

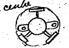
1 Mandril made as per drawing



2 Through hinges back.
3 first put on a clamp like this
4 then put on the slate.
5 then bottom platina cut with 3 ends to connect with the screws when doubled over
6 then put spiral on and throw down leaves & set in threads. spiral
7 put an end in of platina like this with (thread in thick part
8 then put another clamp like this slate



9 then put a piece on mandril to keep the leaves together and the right distance from centre

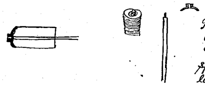


10 Now fill with chalk
11 then put screws in your clamps
12 " take end off and throw back your clamps
13 now fill with chalk the places where the leaves were
14 then screw together by the clamps till you have the right size
15 Now put in slate mandril & heat up high.
16 screw in the platina rod & put collar below the bottom & take off top clamp & it is ready for mounting in the instrument

Electric Light

Dec 5th 1878
Chas Batchelor

Mode of fastening the ends of spiral into end pieces



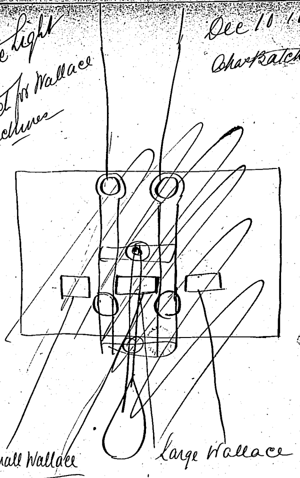
Platina rod is threaded on end and a shoulder cut on it
spiral has the end piece lapped over and pierced so as to let screw through to fasten to top cap

Electric Light

Protector for Wallace machines

Dec 10 1878

Chas Batchelor

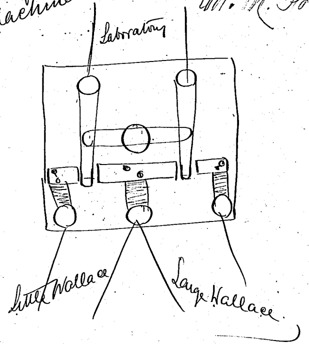


8 10

11

Electric Light
Switch for Wallace
Machines

Dec 10 1878
Chas Batchelor
M. N. Force

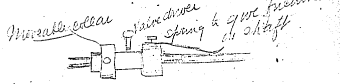


8 1.00

Electric Light — Dec 11 1878 — 13

Chas Batchelor

Tuning fork dynamo



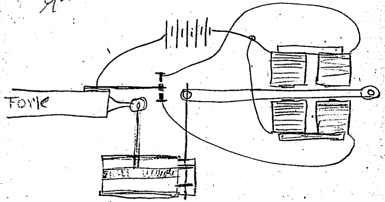
Electric Light

Magneto Electric Generator

Dec 11 1878

Chas Batchelor

M. N. Force



Make the piston thinner & put bearing near crosshead

Connect it up so as to be at rest exactly in centre of cylinder

put new collars on valve stem

Shoulder screw for armature

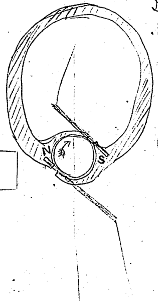
Stud instead of screw on end of armature

Joint up the pipes

Stop screws for armature

Gramme Machine
Commutator

Dec 20th 1878 19
Chas Batchelor



In Gramme armature the pole is carried round in direction of revolution. So it ought to made as in sketch with slices wheels it [illegible]

Magnetism

When the internal resistance of the magnet equals external the best effect is obtained. Ohms law applies to Magnetism.

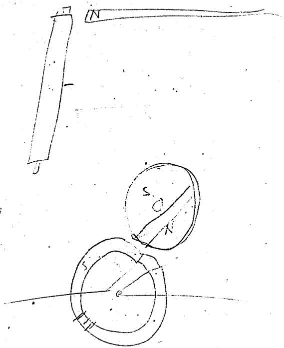
E

~~Pt. sp~~

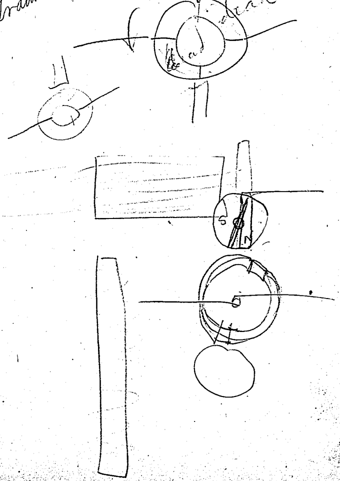
a Pt. spiral moved when heated and no more light given out. Stick gave more owing to greater oxydation.

E

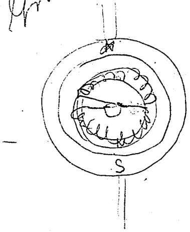
The spiral was rapidly revolved holding it in the hand.



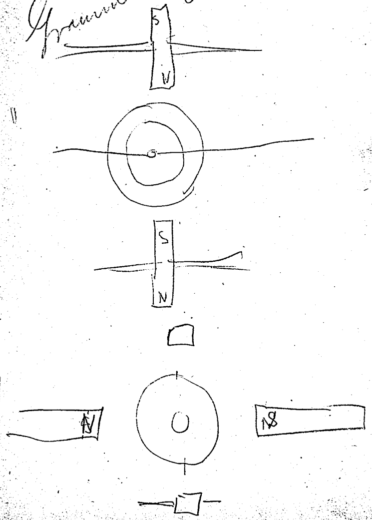
Gramme diagram

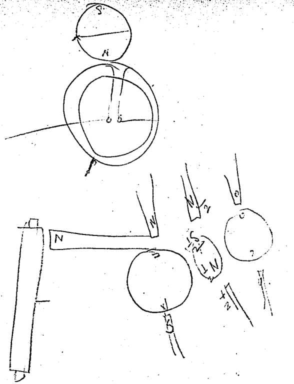


Gramme ring

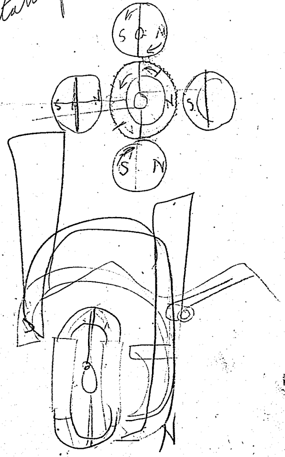


Gramme ring

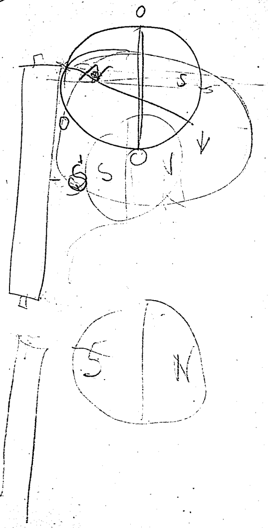




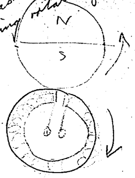
Gramme ring of rotating magnets

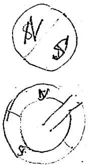


Gramme

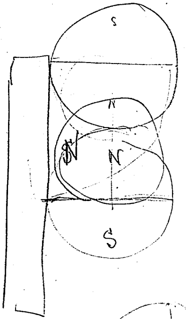


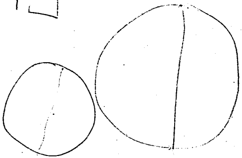
Gramme machine
magnets and ring rotating

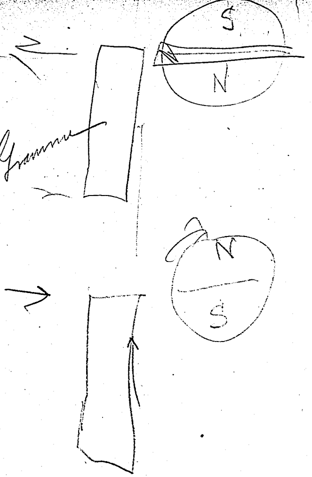




Gramme







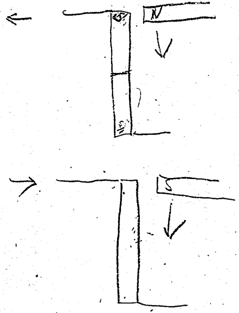
Gramme

Magnetism
Law of currents induced

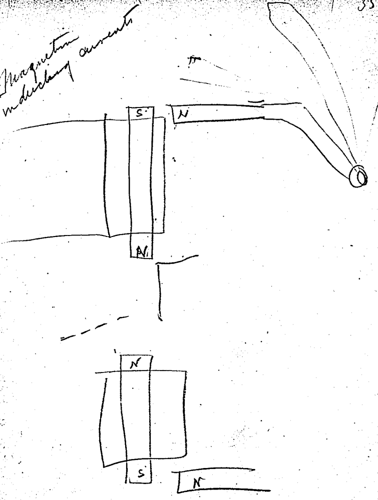
Weakening S same as
strengthening N

stren —— S " "
weakening N

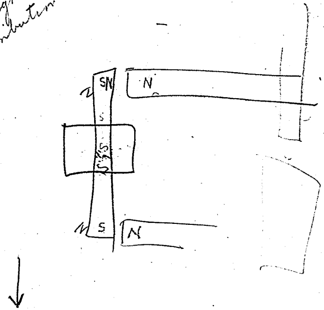
carried in same direction



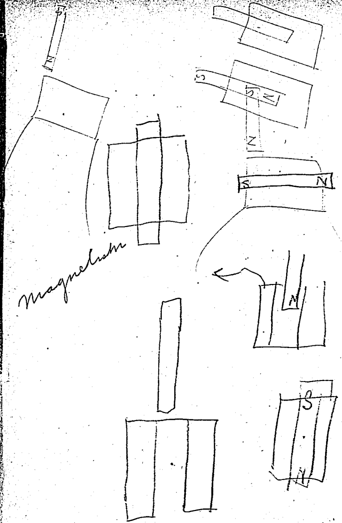
Magnetism inducing currents

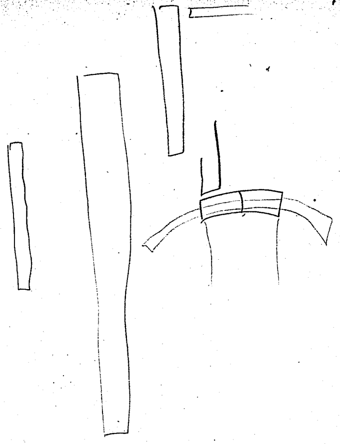


Magnetisation
distribution of induced

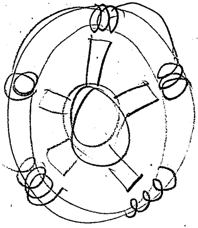


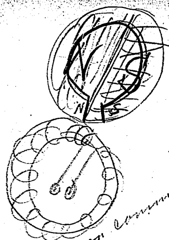
magnetism



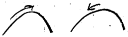


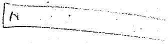
Dynamo ring

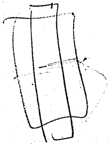




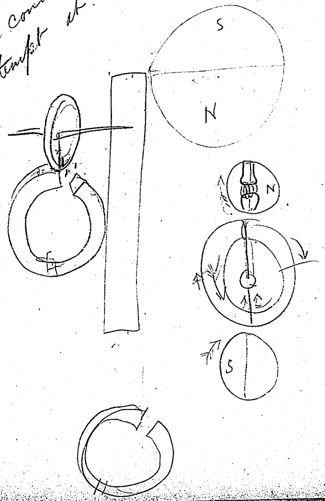
Attempt at non commutator



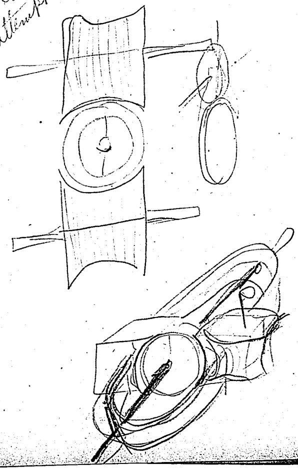


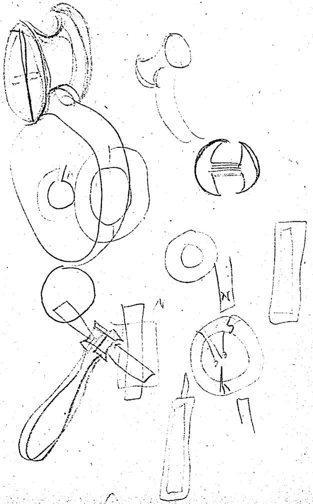


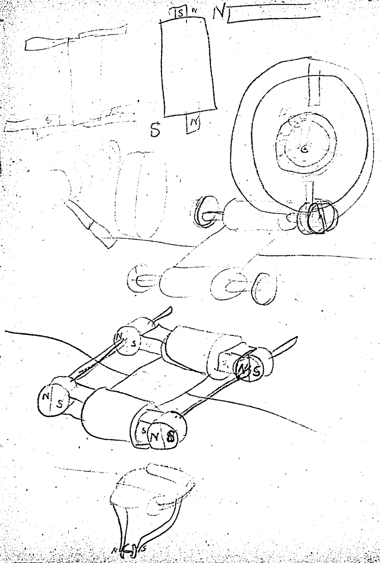
Non commutator
attempt at.



Mon commutator
attempt at.






S
N
N
S
S
N
N
S
N
S
N
S
S
N
S
N
S

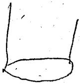
84.5
15.5 3 ohms

63.6
36.4 1 ohm

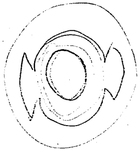
15 : 84.5 :: x : 3

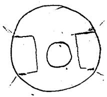
84.5)45.00(.53
42 25
2750

63.6)36.40(.57
31 80
4600



Galvanometer





$39\frac{3}{4}$

9H R

2H R

$\frac{1}{2}$ R

HR 2

No 16 wire

.065

.065
.065
325

.0325
.0325
5

.065
− 5
.07

.035
.035
175
105
.001225
3.14
4900
1225
~~175~~
3675
.003847

1150 to the Ohm

407 feet

.0038) 2.24 (580.
190
340
6

12 .104 .0355
.11 .1055
275
275
.003025
3.14
12100
302
906
.0094828

.0094) 2.24.00 (24
188
460
376

4

.015) 2.240 (1
1 5
74

10

.134
.14

.07
.07
.0049
3.1
49
147
.01519

58 N. 16.

600
488

15

.072
.072
.036
.036

59

.072

.00407.1) 2,240. (560

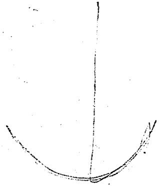
0033) 22400 (660
198
260

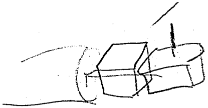
~~560~~
600

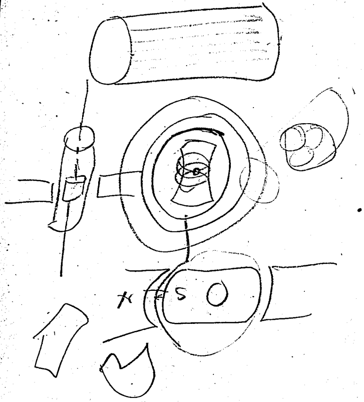
2000

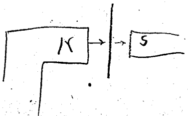
4.9

408
4
1632
12
19584
490






N
S
O


N
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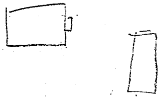
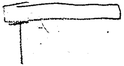
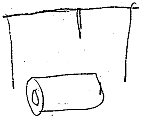
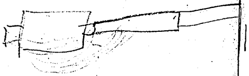








68.376

68.376	4.834900
1.390	3.143015
~~comp 33000~~ 95000000	7.977915
comp 33000	4.578514
	3.377401

60/2508. H.P. for a minute

60/41.7 H P in an hour.

2,005 Grammes H.

68.376

68.376
772

1 lb of H will give — H.P. burned in O.

34.462	4.537345
772	2.887617
26600000	7.424962
33000	4.518514
	2.906448

60/806

13.4 H.P. one hour

Dechenal

1 kilo.

68,376

772

comp. log 2

34.462

67

$$\mathcal{E} = \frac{c}{R}$$

$$\frac{i}{i+j} =$$

$$Z = \frac{i-j}{}$$

58 59
11 2
7

2,167.539.000 | 9.335978
209.336 | 5.321645
| 4.014333

10.320.

~~220 ×222~~

~~402~~ 00.40)

.004.) 1.000(
9

.0039

.0039) 1.0000 Iron

~~II~~ 4.

8.408935

~~5.1065~~

2.408935

256.7 to double

Copper

21

62	100
256	~~200~~
318	200
256	
574	300
830	400
1086	500
1342	600
1598	700
1854	800
2110	900
2366	1000

100 Ohms wanted.

~~.008~~ .01

.01 in Diam.

$\frac{9.7}{7}$ ft per Ohm

= 1.38 ft per Ohm

$\frac{100}{1}$ 138 ft per 100 Ohms

.005

$\frac{2.42}{7} = .345$

34.5 ft per 100 Ohms

When 2000° F

Resistance is 8½ times greater

$\frac{138}{8.5}$ ft per 100 Ohms

2.139879
0.929419
1.210460   16.2

$\frac{34.5}{8.5}$ at 2000° F
1.537819
.929419
.608400

.005 in wire

4.05 ft per 100 Ohms

.020

.02
3.1415
.02

.062830
7

.43901

11 — 50 commenced

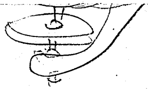
Pages 73 to 93 "Platinum Lamp Notes". Unimportant

Edison Laboratory Note Book # 2.

Page 73.

See Edison Patent

227,229



.020

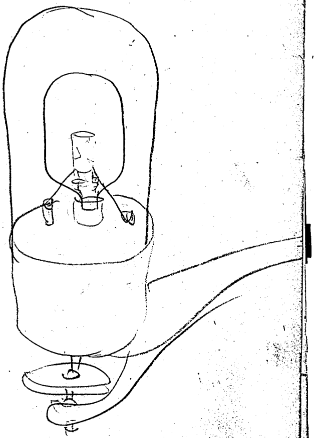
.0[illegible]0

3.1415

2

.062830

7



~~1.1004~~
~~1.000~~

Feb. 8 1879

Platinum Iridium .020 Wire
wound in spiral on
heated once for a
moment to redness in air
then weighed.

Wt. 1.1004 gms (1)

11-55
Then placed in a vacuum
brought to a bright red
Vacuum .2 in 3 cells
kept at red 10 minutes

6 cells incandescent

Table

	Loss	Total
1.1004		
1.1000	.0004	.0004

.0004/1.1000.0

4/11000

3/2750

4/916

6/279

49 Days

49
6
294

to lose 1/4

9 cells 11-45 a.m

Full incandescent

Lower part of the coil seemed to be cross circuited as two turns remained cool

11 cells very white

12 cells 11-48 a.m.

Vacuum holds at 2

Taken off at 11-52 a.m

1.1000 Gr weighs (2)

1.1.004

$\frac{4}{11004}$ $\frac{1}{2751}$

1

1004

1

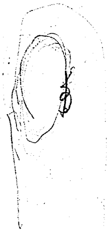
$\frac{4}{10000}$ $\frac{4}{}$

12.38 PM
Spiral—White heat
8 cells C&H New fluid
Vacuum—2 —

12.44 we put 9 cells on
12.47 we put 10 cells on
12.56 " " 11 " "
1. 2 PM 12 cells
1 20 White 13 cells
1 29 White after a shaking
1 38 Yellow

3 Wt 1.0998 Grms.

1.54 P.M Vacuum .2
Acid added out line
6 cells
2 P.M 8 cells white
2-5 " 10 " "
Noticed on the glass a few transparent crystals probably from dirt on the substances wh. have been placed in it as it was not thoroughly clean when Ex. commenced Seemed to have distilled from the top of glass case

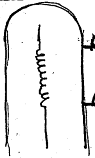


2.25 P.M. 13 cells

Lost .000$\frac{1}{2}$

= .00005

Noticed a black coating around the wire wh, seemed to have a metallic lustre, when looked at against a dark



A Between ~~these~~ A+B
Extremely thin scarcely noticeable

B

Gramme Machine

3–35 Very full white

Galva 60°

About 4 Ohms in circuit

lamps probably .8 Ohm

The vacuum was once very poor

Look out 4 '09

Measured resistance cold lamp

.73 Ohms

total 3.3
.78
2.6

Platinum Spiral

Put in 8.51 P.m.

Weight 1.1243 mgm

60
16
76
6

Taken off 8.57

Put on again 9.02

Taken off 9.10

Put on again 9.11

Taken off 10.07

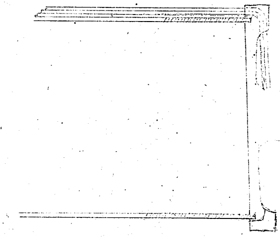
been on 70 minutes

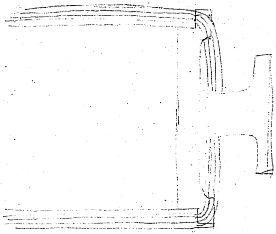
It now weighs 1.1242

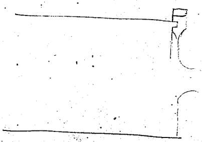
having lost 1/10 of a mgm

Put it on again 10:20
Took it off at 10:50
Weighed 1.1240
Lost in 100 minutes. 3/10 mgm
Put it on again at 11 p.m.
for an hour

took off at 12 m
Weighed 1.1237







375 = 9375
25
1875
750
9370

2.985

314) 9.375
628
3095
2826
2690
2512
1780

15000 = 125
3.5

1125
942
1830

13.8

1000 / 138 X 6?

23)10000(

1020 / ~~138~~ X ~~60~~

23)1020(44,34

92

100

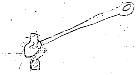
92

80

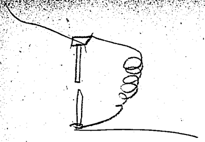
69

210

207



The invention is for regulating the distance apart of the Carbon Electrodes = and he in 1 case uses the movement in a metallic conductor due to the passage of the current to ~~effect directly or~~ to release certain mechanism to effect the ~~sepert~~ separation of the Carbons



He shunts the arc with a magnet or solenoid, & in pp 44 & 49 6 - Letomdens says that he uses the Expansion of wire to effect the separation of the Carbons & the magnet to release the mechanism, this magnet forms a constant derived Circuit around the arc

~~in another arrangement~~

~~He~~

In a case he meets a
fusible wire in the derived
Circuit around the arc
Containing the magnet
to prevent its destruction
with great current.

in another arrangement
see p 4, line 9 & 10
Hence fusible wire, (which is
not the expansible wire)
this fusible wire connects
to a commutator which

comes in play only when
the wire fuses. and thus
preserves the continuity of
the circuit, so that other
lamps shall continue to
burn; now the expansion
of this fusible wires produces no
effect whatsoever as
it only can work by its
fusion & when the lamp
has reached a point
it cannot work

~~Hold~~

In one case he mentions
that a semi-metallic device
may replace the fusible
wire around the Carbon points, whose expansion
may ~~cannot~~ ~~and cut~~
the commutator ~~and the~~
~~Sole object of this is to~~
~~close so as to close the~~
~~circuit of the arc of the~~
~~is the case~~ the circuit of
the arc, now if this

Expansion wire is around
the arc; ~~it would permanently~~
~~short circuit it owing to~~
~~its low resistance, the expansion~~
~~that it is to replace the fusible wire,~~
~~if it was in the main~~
~~circuit~~ outside of the
lamps (~~[illegible]~~ and forms a
derivation around it in
connection with the releasing
of the mechanism magnet
it would ~~[illegible]~~ Expand upon the
arc being broken by a
greater accession of.

Current this it is
supposed would bring the
Commutator into play &
short circuit the arc,
but the effect of this
Expansion is not to
throw in & out resistance
because the resistance is
always in circuit & is
independent in this
galvanism of the
movement of the
Expansible wire.

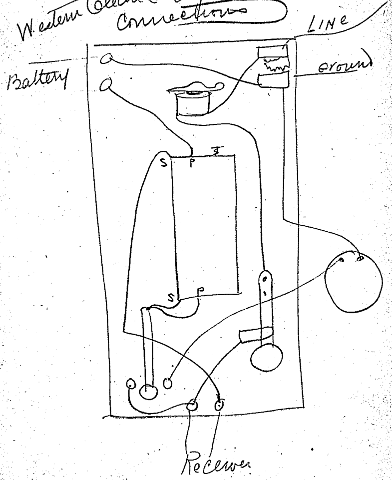
not only does this device
~~not throw in & out resistance~~
~~of~~ in the line Either to
regulate or vary ~~the strength~~ of
the ~~current~~ but is only
used in cases when the
~~lamp off arc has~~ light
has been destroyed it
~~lamp not~~ neither does
it regulate in any
manner the Composition
of the Lamp

It will be noticed that the resistance which he uses is ~~claimed~~ in the line, and is of such an amount that it is proportioned to the strength of the current. Further that he does not describe, allude or claim any method ~~to~~ whereby the expansion of a conductor is made to throw in & exclude from

a circuit a resistance. I wish further to remark ~~that I have submitted~~ the Specification and drawings to several skilled Experts in ~~that~~ art to which it relates and ~~that~~ they are unable to any similarity between the two inventions not only do ~~they~~ they see no ~~similarity~~ similarity but I ~~Can~~ they cannot understand how an operative mechanism could be made from the

general and Confusing statement of the patent in question

Western Electric Telephone Connections



2 cts.

365

36.50
2
7300
2
14600
2
29200

36.50
2
73.00
2
14600
2
29200
2
58400

36.50
18.25
54.75
2
10950
2
21900
2
43800

73.
24
292
146
1752

54.75
24
21900
10950
131400

36.50

5/16

16 | 50 (.3125
48
20
16
40
32
80

.004

.3125 inches surface

.03125 inches straight line having 10 ohms

004
314
.01256
3
.03768

(12.5 ~~ohms~~
4.13 ~~inches~~
in 4 inches

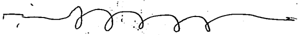
.005 .00

.003

.004

4 inches 4)64
16

64



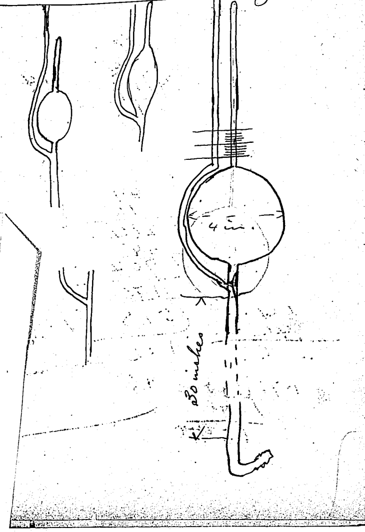
44.
16
264
44
704
176
528 ft. lbs
176 per candle

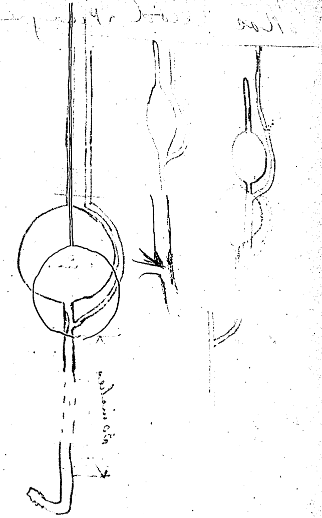
64

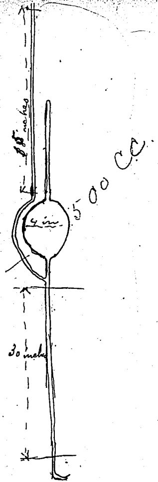
64
44
2 6

176)33000(18
176
1540

Mac Cleod Guage






18 inches
4 in.
500 CC.
30 inches

·76

3800
8
30400

6

64.

$$64 \overline{)3800} \; (59.$$
320
600
576

64
59

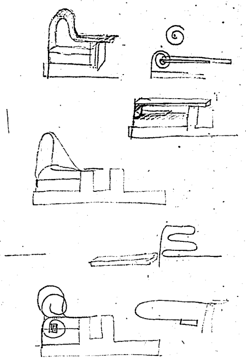
64
60
3840.

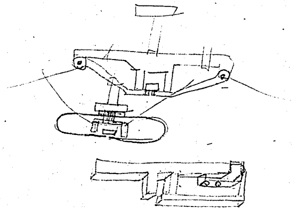
1

5 100

2

1 2





~~10~~0	2.2041
~~7~~72	2.8872
~~10~~	1.
	6.091.3

1,230,000

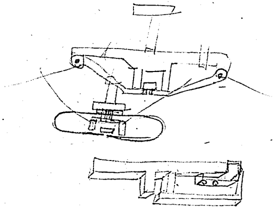
6.0913
33.000 4.5185
1,5728

37.4

4

$3\overline{)39}$ 13

3 / 4.00
3 / 1.333
4 / .444
.111



~~160~~	2.2041
~~772~~	2.8872
~~10~~	1.
	6.0913

1,230,000

$$\begin{array}{r} 6.0913 \\ 4.5185 \\ \hline 1,5728 \end{array}$$

33.000

37.4

4

3/4.00

3/1.333

4/.444

.111

3/39

13

	P.	S.	T.
1	.41	118	405
2	.41	116 with bells	380
3	.42	140	405
4	.43	140	430
5	.42	145	430
6	.43	147	427
7	.35	145	372
8	.43	143	427
9	.35	150	425
10	.43	140	430
11	.43	142	442
12	.46	135	400
13	.43	1.37	420
14	.45	136	410

140

New Coils with proper amount of Resistance

Saxon

Number of Instrument

Sept. 29

J. F. Kruesi

25 X
36 X
34 X
28 X
48 X
49 X
32 X
43 X
39
29

X means good

35 good. R. S with B T

changed

	R	S with B	T
48	.47	124	347
38	.40	122	ok 370

49

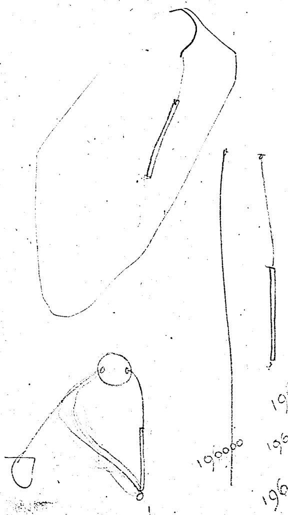
49

141

Tests of Coils of Edison telephones

Sept 19th 1879

No of Inst	Primary	Secondary	Tertiary	Remarks
33.	ok .32	with Bell 141.	350.	
23	.40	141		
34	.20	125		must be fixed
43	ok. 25			Fixe this
41	.40	143	417	
36.	.20	—	—	investigate
29	ok. 21			investigate
46	.24			investigate
49	ok .05			Big big
51	.34	153	370	
37	.40	128	379	
26	.41	with Bell 142	377	
31	.26			
33	.31	143	375	
43	.24	130	372	
46	.44	174	435	



19667

196966

19000

190000

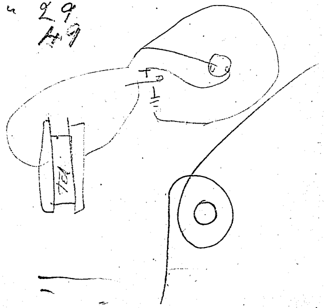
196000

19676

No 29 — 23 Light pressure — Heavy press

Nos. of Telephones ~~with~~ whose calls have been changed

No 32
" 43
" 39
" 29
49



	Light pressure	Heavy pressure
No 49	5.	
No 29	23	11.20.
" 36	6.30	2.9.
43	16.5	7.3
34	Insulated at all pressure	

20.

4V

Test to ascertain reliability of resistance in hard carbon buttons,

NO	LIGHT PRESSURE	HEAVY PRESSURE
29	23.00	11.20
36	6.30	2.9
43	16.5	7.3
34	Insulator	Insulator.
46	3.0	2.0
34 Thompson Carbon	11.20.	5.
our Lampblack Carbon Eddys [illegible]	33.00 little heavier Pres = 24 ohms	14.
ditto filed flat	ohms 47.95 –	ohms 12 ½ (very heavy = 4 [illegible] .3 [illegible])
again	33 ohms = talking loud 26	again 27.40 again talking 92.
[illegible] Planings	6.80.	1.61

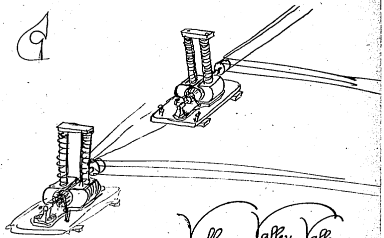
McLaughlin has just returned from the Chandiere River & the Lelonp's Canada where there are placer mines This alluvial is said to contain a minute trace of Platinum & Iridosmine McL brings some of the black sand from the sluces before the fine gold is panned from it. By the aid of the Microscope I ascertain that The platina is combined with the gold also in seperate pieces, The Pt is not alloyed with Au but is in Contact with it. - The amount of Platinum is about $\frac{1}{4}$ that of the Gold. Iridosmine is very plentiful. It forms a large

bulk of the sand there is
probably 6 oz of Iridosmine
to every oz of Gold, I have
found that Sodium amalgam
will take up the Iridosmine &
platinum, the Au being previously
taken out by pure Mercury —
There is undoubtedly enough
Pt & Iridium in the Canada
district to supply the world
instead of the blocks and
containing a trace of the platinoid
The mine should be called a
platinoid mine with trace of
gold —

T. A. E.

June 6 1879 —

G



Valley Valley Valley

Portchester

Wabash

Portchester Valley

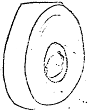
Portchester

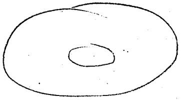
Portchester Wabash

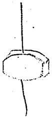
Memphis Memphis
The substitution of the efficacy due to
Memphis
Portland maine Maine Maine
Now by Saint Paul my Golden
Maine Maine Maine
Memphis Memphis
Frangapani
Memphis Memphis Frangapani
Valley Valley Valley Valley
Saturated economics Economics
Chandiere Economics
Chandiere
Franklincle
Chandiere Chandierix
Circumference
Chandiere Frangapani
Chandiere
Frangapani

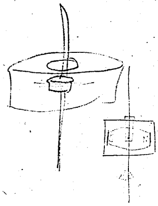
Saturated Soulution of Caustic
potash =
fuse ~~the~~ solid salt of
Caustic potash & also
of Soda in matter state
pour in a mould & then
turn them off =
also fuse the Caustic soda
mixed with 1/4 its weight of
chalk mix & pour hot =
Ditto with the potash salt ~~solution~~

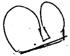
again make another
and mix 1/2 its weight of
Chalk =

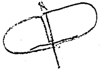


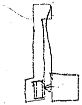


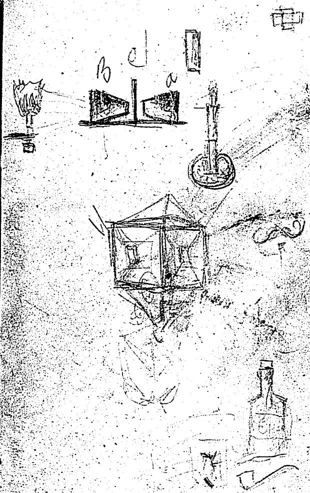


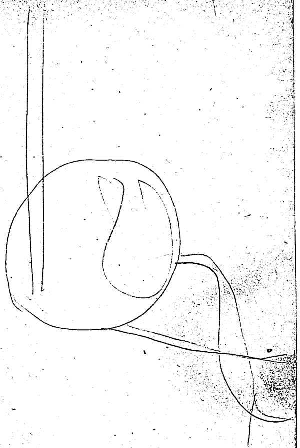









B
d
a

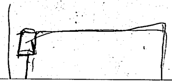


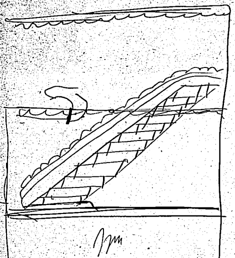
Menlo Park Notebook #3 [N-78-11-21]

This notebook covers the period November 1878-January 1880. It contains tests for non-radiating substances conducted by John K. Knight during November and December 1878 and results of Knight's research to find a chemical to extend the red spectrum. There are also entries by Edison, Charles Batchelor, Francis Upton, and John Kruesi. These include notes, drawings, and calculations about generators; drawings of lamp sockets; miscellaneous drawings, calculations, and experiments relating to electric lighting; notes by Edison on thermopiles; and notes by Batchelor on Edison's telephone. The book contains 282 numbered pages.

Blank pages not filmed: 24-25, 82-83, 116-117, 158-161, 194-199, 202-237, 242-249, 252-281.

No 3

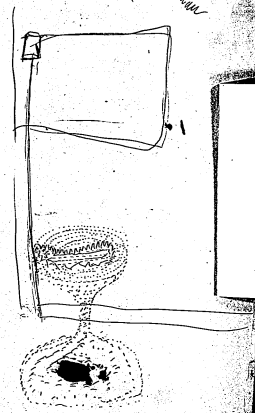




12

No 3

[illegible]



12

Tests for Non Radiating Substances

Source of Heat Cube of Hot Water 19[illegible]
Tot – Thermopile + Galv

Constant of Tin Cube 5 deg[illegible]

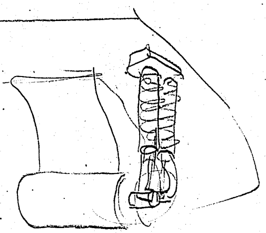
Substance		Degrees Deflection
Amygdaline	1/100 Sol	4°
Iodine of Iron	1/20	8°
Caustic Potash	1/20	7°
Caustic Potash & Gum Benzoin	1/100	6°
Glycerine Sol	40/100	14° X
Gum Guiacum	1/100	10°
Manganese Sulphate		8°
Tartaric Acid		6°
Bismuth Nitrate		11°
Mercuric Nitrate		4°

Continued Nov 21. 98 HKR
" 22

Chemicals	Degrees deflection
Chloride Lime	6°
Ammonic Oxalate	10°
Sulph Magnesia	6°
Lamp Black	20° X
Glycerine	21° X
Lamp Blk & Glycerine	21°
Caustic Potash Sol	10°
Phosphate Lime & Glycerin	21°
Pepsine Sol. 1/20	11°
Gum Shellac & Caustic Potash Sol 5/100	12°
Valerianate of Zinc 1/100	8°
Licorice Sol 20/100	18°
Gum Arabic " 1/100	11°

Continued Nov. 22/78
OKK 23/78

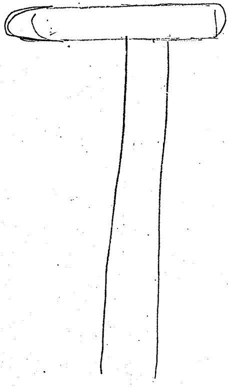
Chemicals		Deflection
Tannic Acid	1/20	14°
Sulph Copper	1/20	15°
Chrome Alum		16°
Paris Green		19°
Spermaciti		9°
Cocoa Butter		16°
Starch		7°
Starch Iodide		12°
Bronze on Glycerine		10°
Sulph [illegible]		8°
Sulph Antimony		10°
Sulphur in Sperm Oil		9°
Sulphur in Bi Sulph Carbon		8°



OKR

Chemicals	Deflection
Ammonia Water	7° / 8°
Sulph Potash - Sat.	
Sulph Antimony in Bi Sulphide Carbon	10°
Nitrate Strontia 40/100	9°
Aloin 1/100	12°
Paper White	8° ×
" Glycerine	20°
" Lampblack	18°
" Litmus Sol	10°

over



Continued Nov 25. 98
OKK

Chemicals		Deflection
Paper Camphoric Acid	1/100	13°
" Chloride Lithium	1/5	9°
" Hyposulphate Soda	1/5	11°
" Cyanide Mercury	1/100	12°
" Sulphate Quinine	1/100	10°
" Acetate Nickel	6/100	9°
" Dextrine Sol		10°
" Balsam Copabia		14°
" Balsam Peru		20°
" Venice Turpentine		15°
" Collodion (Thin)		5°
" " (Thick)		4°
" Albuminized (only)		8°

Continued. Nov 26. 98.
H Knight

Chemicals	Deflection
Paper Oil Rosemary	9°
" Coach Body Varnish	10°
" Wearing Body Varnish	9°
" Oil Wintergreen	11°
" Oil Pennyroyal	13°
" Creosote	12°
" Cade Oil	18°
" Tannic acid	7°
" Oil Citronella	9°
" Oil Tansey	10°
" Oil Spruce	12°
" Balsam Fir	14°

Continued Nov 27. 78

T. K. Knight

Chemicals	Deflection	
Paper Oil Spearmint	9°	
" " Bergamot	9°	
" " Sarsaparilla	12°	
" Furniture Varnish	15°	
" Oil Cubebs	14°	
" Union Salad Oil	10°	
" Bi Carb Soda	8°	
" Bi Chrom Potash	11°	
" Chloral hydrate	12°	
" Dextrine & Acetic Acid	6°	X
" Amenomic Acid	4°	

Continued. Nov 28. & 29 - 1878.
J. K. Knight

Chemicals	Deflection
Paper Lead Acetate	12°
" Sulph Potash	10°
" Chloride Zinc	10°
" Chloride Ammonia	13°
" Sodic Nitro Prusside	10°
" Permanganate Potash 5/100	10°
" Tartarate Manganese 1/100	12°
" Dextrine & Fluor Spar	5°
" Gamboge	8°
" Anthracate Potash	8°
" Caustic Potash 5 Grns Gum Sandaric 5 " 100 H.O.	11°

Continued Nov 29. 1878
" 30 D. A. Knight

Chemicals	Deflection
Paper Chrome Alum	12°
" Phosphate Lime - Gum	10°
" Blk. Ox Manganese "	6°
" Fluor Spar "	4°
" Silicic Acid "	10°
" Caustic Baryta "	7°
" Gum Tragacanth "	13°
" Powdered Marble "	8°
" Burnt Umber "	10°
" Tellurium Ore "	12°
" Fire Clay "	11°

Continued Nov 30 & Dec 2 78
J H Knight

Chemicals	deflection
Paper Tripoli - Gum	8°
" Rotten Stone	10°
" Vellumin (Thick)	10°
" Marble "	9°
" Rotten Stone "	9°
" Gum Damar	12°
" " " Fluor Spar	9°
" Mica (Thin)	10°
" Chalk	
" Alumina	12°
" Caustic Magnesia	11°

Continued Dec 2. 78
" 3 78 DAK

Chemicals	Deflection
Paper Carb Baryta	9°
" Fire Clay & Collodion	9°
" Chalk & Collodion	9°
" Blk Oxide Mang & do	5°
" Chalk & Asbestos	8°
" Chalk (Thin)	11°
" Crocus Antimony Plaster Paris	9°
" Blk Ox Manganese " "	8°
" Plaster Paris	10°
" Peroxide Lead " "	12°
" Hypophosph Iron " "	9°

Thick Paste

96

Dec 6. 1898
JKnight

Spectrum Tests

To find a chemical that will Extend the Red Spectrum

Picale Ammonia	1gr 100 H2O	Reduces
Chlor Barium	1 " 100 "	Reduces
acetate Zinc	5 " 100 "	Reduces
Flavonide: Sodium	1 " 100 "	Reduces Slightly
Sulpho Carbolet Lime	1 " 100 "	Reduces "
Baptisen	1 " 100 "	Reduces "
Chloride Lead	1 " 100	Reduces
acetate Uranian Potash	5 " 100.	Reduces
Iodide Potassium	1 " 100 "	Reduces
Gum Senegal } = { Caustic Potash	5 " : 1 " 100 "	Reduces
Citric acid	20 " 100.	Reduces
Iodide Zinc	5 " 100 "	Reduces
arsenious acid	5 " 100 "	Reduces

28

Dec 6th and 1878

Jno. Kingston

Carbozotate Ammonia	1 gr	100 Ho	Reduces
Oxalate Ammonia	5 "	100 Ho	"
Salicine	5 "	100 Ho	"
Chloride Ammonia	1 "	100 Ho	" Slightly
Sulph Quinine	100 Ho	100 Ho	" "
Acetate Strontia	5 gr	100 Ho	Reduces
Caustic Baryta	5 "	100 Ho	" "
Chloride Strontia	50 "	100 Ho	" Slightly
Sulphate Lithia	1 "	100 Ho	Reduces
Sulphate Caffin	1 "	100 Ho	"
Protochloride Tin	5 "	100 Ho	" Slightly
Picrotoxin	500 Mn	100 Ho	No Variation
Sulph Morphia	1 gr	100 Ho	Reduces
Boracic Acid	3 "	100 Ho	"

Over

Dec^r 7^th 1878

Thos K Knight

Spectrum Tests – continued TKK

Sulphide Magnesia	1 gr 100 H_2O	Reduces Slightly
Amygdaline	1 " 100 "	No difference
Sulpho Vinate Soda	20 " 100 "	Reduces
Sulphate Alumina	5 – 100 –	Reduces
Iodide Calcium	5 . 100 .	Reduces Slightly
Lupulinss	1 – 100 –	Reduces
Sulpho Carbolate Soda	5 100	Reduces Slightly
Sulpho Cyanide Pottassium	1 " 100 –	No Change
Sulphuret Calcium	1 – 100	Reduces
Valerinate Zinc	1 " 100 "	No Change
Acetate Nickel	6 – 100 –	Reduces
Proto Acetate Copper	1 – 100	Reduces

over

Dec 9th 1878
Jno. K. Knight

Spectrum Tests. continued

Hyposulphite Manganese	1 gr. 100 HO	Reduces
Acetate alumina	1 gr 100 HO	Reduces
Camphoric acid	1 gr 100 HO	Reduces
Alum	1 gr 100 HO	Reduces Sligh
Valerianate Magnesia	1 gr 100 HO	Reduces
Manganate Soda	1 gr 100 HO	Reducts
Stannate Soda	5 gr 100 HO	Reduces
Camphoric Acid	20 grs 100 "	Reduces lit
Sulphate Soda	20 gr 100 "	Reduces lit
Nitrate Strontia	1 gr 100 HO	No variatio
Sulphate Cobalt	1 gr 100 HO	Reduces
Arsenate Soda	5 gr 100 HO	Reduces

Dec 9th 1878 Jno. H. Knight

Spectrum Test Continued

Citrate Potash	1 gr 100. H_2O	Reduces
Sulph Quinidine	200 mil 100 H_2O	No diff
Citrate Quinine	100 mil 100 H_2O	Reduces
Hyposulph Soda	1 gr 100. H_2O	Reduces little
Hippuric Acid	150 m 100 H_2O	Reduces
Arsenate Quinine	1 gr 100 H_2O	Reduces
Carbonate Soda	20 gr 100. H_2O	Reduces
Hyposulph Soda	20 gr 100 H_2O	Reduces little
Citric Acid	40 gr 100 H_2O	Reduces
Phosphate Lime	1 gr 100. H_2O	Reduces

Dec 10 1878 Jno. H. Knight

Spectrum Tests Continued

Gum Arabic	20 gr	100 HO	Reduces
Oxalate Soda	3 gr	100 HO	Reduces
Arsenite Soda	5 gr	100 HO	Reduces
Sulphate Zinc	5 "	100 HO	Reduces little
Sulphuret Barium	1 "	100 HO	Reduces
Tartrate Soda	20 "	100 HO	Reduces
Bi Carb Soda	8 "	100 HO	No percept. chg
Tungstate Soda	20 "	100 HO	Reduces
Borate Soda	8 "	100 HO	Reduces
Bromide Potassium	20 "	100 HO	Reduces slight
Bromide Cadmium	5 "	100 HO	No change
Chlorate Potassa	3 "	100 HO	Reduces

Dec 10th 1878 Jno Kruesi

Spectrum Tests Continued

JHK

Formate of Copper 1 gr 100 HO	Reduces
Sulphate Nicinium 5 gr 100 HO	Reduces
Bichromate Potash 3 gr 100 HO	Reduces
Phosphate Ammonia 5 gr 100 HO	Reduces Slightly
Cochineal Sol — —	Reduces
Phosphorus in Bi Sulp Carbon — —	Reduces little
Trichromate Ammonia 5 gr 100 Aq	Reduces
Formiate Soda 5 gr. 100 HO	Reduces little
Sulphate Magnesia 40 gr 100 HO	Reduces
Per Nitrate Iron Tinkson Sol	Reduces
Acetate Baryta 5 gr. 100 HO	Reduces
Mollybdaenic Acid 200 m 100 HO	Reduces Slightly
Mercuric Nitrate —	No Change

Dec 11th 1878
[illegible]

Spectrum Tests Continued
Dec 11. 78 JKK

Lead Acetate	—	Reduces little
Sulph Potassium	—	No apparent Change
Oxalate Soda	1 gr 100. HO	Reduces
Pepsin	1 gr 100. HO	Reduces little
Nitrate Magnesia	1 gr 100 HO	Reduces
Citrate Ammonia	1 gr 100 HO	Reduces little
Nitrate Uranium	1 gr. 100 HO	Reduces
Saponia	1 gr 100. HO	Reduces
Chloride Iridium	1 gr 100. HO	Reduces little
Phosphate Manganese	1 gr. 100 HO	Reduces
Lacto Phosphate Bismuth	1 gr. 100. HO	No Change
Phosphate Potash	1 gr 100 HO	Reduces

over

42

Dec 11th 1878
Jno K Knight

Spectrum Tests Dec 11 78
K Knight

Chloride Strontia	20 gr 100 Ho	Reduces
Phosphate Calcium	1 gr 100 Ho	Reduces little
Grape Sugar	20 gr 100 Ho	Reduces
Bi Carb Potash	5 gr 100 Ho	Reduces
Phosphate Ammo & Soda	5 gr 100 Ho	Reduces
Monochloric Acetic Acid	5 gr 100 Ho	No change
Sulph Cinchonidin	1 gr 100 Ho	Reduces little
Sulphate Strontia	1 gr 100 Ho	Reduces
Sulphate Strychnine	1 gr 100 Ho	Reduces
Citrate Potash	5 gr 100 Ho	No Change
Hyposulphate Baryum	5 gr 100 Ho	Reduces little

44

Dec 13th 1878
Jno. K. Knight

Spectrum Test Dec. 12. 78 45

John K. Knight

Acetate Strychnine	1 gr 100 HO	Reduces little
Iodide Zinc	1 gr 100 HO	Reduces
Acetate Barytum	5 gr 100 HO	Reduces
Nitrate Silver	1 gr ~~100~~ HO	Reduces
Flouride Sodium	5 gr ~~100~~ HO	No change
Lactate Quinine	1 gr 100 HO	Reduces
Sulph Lead	5 gr 100 HO	Reduces
Chloral Hydrate	1 gr 100 HO	Reduces little
Chlorine	—	Reduces
Magnesium Sulph & Am Ch	—	Reduces
Stannous Chloride	—	Reduces
Sulphate Lime	1 gr 100 HO	Reduces

over

Dec 12th 1878

Jno. Kruesi

Spectrum Test Continued

Dec 12-78 JKK

Asparagin	1gr 100 H_2O	Reduces little
Propylammin Chl	1gr 100 H_2O	Reduces
Iodide Amm	1gr 100 H_2O	Reduces
Glycerine	5gr 100 H_2O	Reduces little
Venice Turpen -	5gr 100 H_2O	Reduces
Caustic Potash =	1gr 100 H_2O	
Gamboge	2gr 100 H_2O	Reduces
Ferrideyanic Potass	3gr 100 H_2O	Reduces little
Sulphate Beberine	1gr 100 H_2O	Reduces
Balsm Peru Caustic Potash	1gr 2a 100 H_2O	Reduces
Sesqui Chlor Iron	5gr 100 H_2O	Reduces little

Over

Dec 13. 1878

Jno. H. Kniffin Jr.

Spectrum Tests Continued
Dec 13, 78, JKK

Gamboge	5 gr	100 Ho	Reduces
Caustic Potash	1 gr		
Gum Benzoine	5 gr	100 Ho	Reduces
Caustic Potash	1 gr		
Balsam Tolu	5 gr	100 Ho	Reduces
Caustic Potash	5 g		
Gum Guacum	5 gr	100 Ho	Reduces
Caustic Potash	1 gr		
Hydro Potassic Tartarate	–		Reduces
Potassic Hydrate	–		Reduces little
Potassic Carbonate	–		Reduces
Potassic Tartarate	–		No change
Potassic Nitrate	–		Reduces little

502

4

Dec 13. 1878

Geo. H. [illegible]

37

Spectrum Tests Continued

Dec 13. 1878

Hydrosulphuric Acid	Reduces like
Benzoic acid	No change
Chlorine Water	Reduces
Nitro Hydrochloric acid	Reduces like
Cupric Sulphate	Reduces
Cupric Nitrate	Reduces like
Chromic & Potassic Sulphate	Reduces [illegible]
Nickel Sulphate	Reduces
Anthracate Potassa in 5 pr 100 H_2O	Reduces
Mercuric Chloride	Reduces like
Argentic Nitrate	Reduces
Ammonic Molybdate	Reduces like

Dec 14th 1878
Jno [illegible]

Spectrum Test Continued

Dec 13 14 78 JKK

Palladic Chloride	Reduces
Indigo Solution (weak)	Reduces
Ferric Chloride	Reduces [illegible]
Ammonia Water	No change
Solutn Tersulphid Arsenic in Ammonia	Reduces
Lithmus Solutn	Reduces
Sodic Nitro Prusside	Reduces
Tannic Acid	Reduces
Ammonia Sulph Hydrate	Reduces Slight
Pyroxylic Spirit	Reduces lit[illegible]
Benzin	Reduces lit[illegible]

Dec 14th 1878 [illegible]

Spectrum Test Continued
Dec 14th 1878 JKK

Sesquichloride Iron Sol.	Reduces
Sulphurous acid	Reduces little
Alcohol	Reduces little
Alcohol & Cochineal	Reduces.
Alcohol & Caustic Soda	Reduces little
Alcohol & Cadmium Chloride	Reduces little
Alcohol & Santonine	Reduces slightly
Sol Quinine in H_2O	Reduces
Sol Quinine in alcohol	Reduces
alum water	Reduces little
Glycerine. strong	Reduces little
Glycerine & Chlor Iron	Reduces

Dec 14th 1878
J. A. Kruesi

Spectrum Test Continued
Dec 14 78 JKK

Balsam Caporia or Mica	No Change
Alcohol & Salycolic Acid	Reduces little
Balsam Caporia & oil Lemon	Reduces little
Glacial Posphoric Acid	Reduces
Crystal Ferro Cyanide Potassium (transparent)	Reduces little
Alcohol & gum Hemlock	Reduces
Paraffin on glass Transparent	No Change
" " " White	Reduces
Silicate of Soda	No Change
Oil Fennel	Reduces slightly
Fusel Oil	No Change
Oil Spearmint	Reduces

Dec 16th 1878
Jno. Knight

Spectrum Tests Continued
Dec 16 1878 JKK

Alcohol & Anilin Sulphate	Reduces little
Oil Cloves on Mica	Reduces
Oil Juniper berries on "	Reduces
Oil Wormwood " "	Reduces
Oil Croton " "	Reduces little
Oil Lemongrass " "	Reduces little
Oil Peppermint " "	Reduces little
Oil Bergamot " "	Reduces
Oil Pennyroyal " "	Reduces
Oil Anise " "	Reduces little
Oil White Thyme " "	Reduces little
Oil Juniper wood " "	Reduces

Dec 16th 1878
[illegible]

Spectrum Test — Continued
Dec 16th. 1878. [illegible]

Oil Citronella on Mica	Reduces [illegible]
" Orange " "	Reduces
" Lavender Flowers " "	Reduces
" Carui " "	Reduces
" Cassia " "	Reduces
" Oil Rosemary " "	Reduces
Hydrochloric Acid & Ammonia Fumes	Reduces
Crystal of Gum Damar	Reduces
" " Alum	Reduces
" " Camphor	Reduces
" " Saltpeter	Reduces
" " Gum Sandric	Reduces

Dec 17th 1887 [illegible]

Spectrum Tests continued

Dec 17th [illegible] JKK

Crystal of Ferrous Sulphate	Reduces
" " Sulph Copper	Reduces
" " Bi Chromate Potash	Reduces
Glycerine & Picrotoxin	Reduces
" " Amygdaline	No Change
" " Sulphate Quinidin	Reduces little
" " Valerinate Zinc	Reduces little
" " Nitrate Mercuric	Reduces
" " Sulphate Potash	Reduces little
" " Lacto Phosph Bromine	Reduces little
" " Bromide Cadmium	No Change
" " Bi Carb Soda	Reduces little
" " Ammonia Water	No Change

Dec 17. 1878
[illegible]

Spectrum Tests Continued
Dec 17th 1878. [illegible]

Glycerine and Nitrate Strontia	No change
" " Balsam Copavia	Reduces little
" " Paraffin	Reduces
" " Silicate Soda	Reduces little
" " Fusel Oil	Reduces
" " Potassic Tartarate	Reduces little
" " Citrate Potash	Reduces
Aniline Oil & Citrate Potash	Reduces little
" " & Picrotoxin	Reduces little
" " & Valerinate Zinc	Reduces little
" " & Amygdaline	Reduces little

Dec 17th 1878 Thos. K. Knight

Dec 17th 1878 TKK

Aniline Oil & Quinidine Sulph	Reduces little
" " & Bi Carb Soda	Reduces
" " & Bismuth Lacto phosph	
" " & Cadmium Bromide	
" " Sulphate Potash	Reduces little
" " Mercuric Nitrate	Reduces
" " Tartrate Potassium	-
" " Fusel Oil	Reduces little
" " Silicate Soda	Reduces
" " Balsam Copaiva	Reduces
" " Nitrate Strontia	Reduces

Dec 18th. 1898 Jno. A. Knight

Spectrum Tests. continued

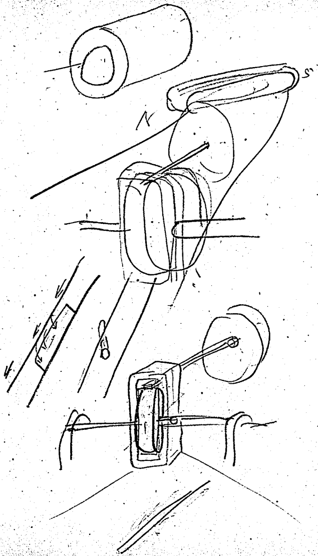
Dec 18. 1898 J.A.K.

Aniline Oil & Ammonia	Reduces.
" " Sulph Zinc	Reduces little
" " Chloral Hydrate	Reduces little
" " Caustic Potash	Reduces
" " Balsam Peru	Reduces.
" " Benzoic acid	Reduces little
" " Tannic acid	Reduces
" " Cochineal	Reduces
" " Quinine	Reduces
" " Dextrine	Reduces
" " Chloride Zinc	Reduces little
" " Glycerine	Reduces

Dec 18th 1878
Jno. K. Kruesi

Spectrum Test Continued
Dec. 18. 1878 JKK

Aniline Oil and Alcohol	Reduces little
" " Valerianic Acid	Reduces little
" " Fresh Acid	Reduces R
" " Citric Acid	Reduces little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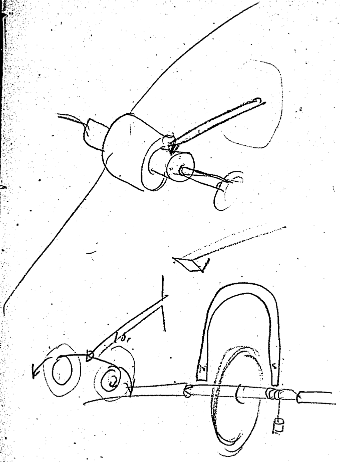

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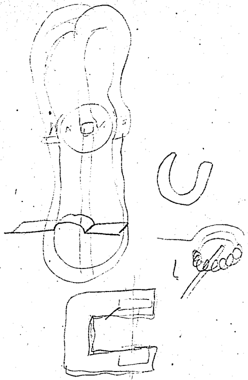

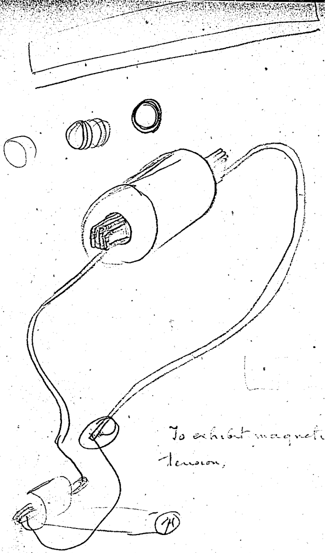

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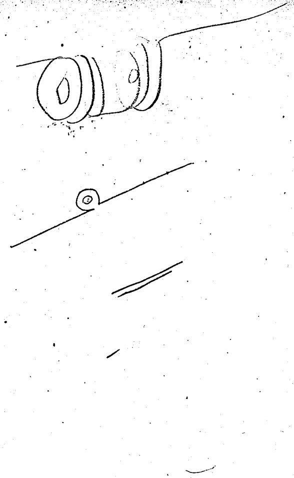

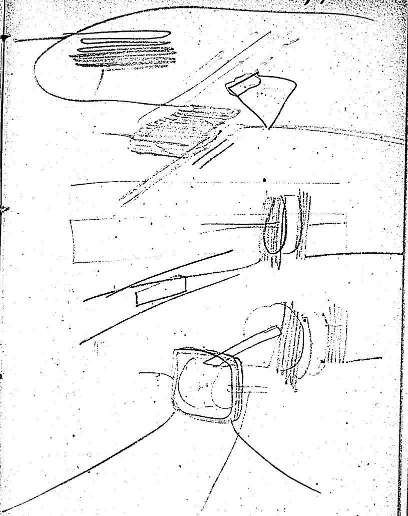

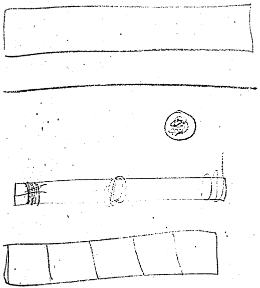

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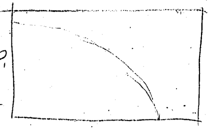

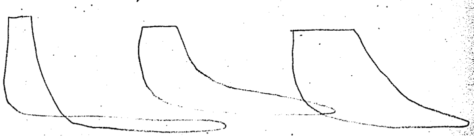

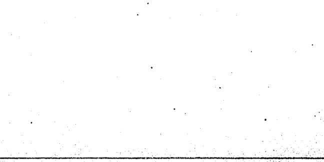

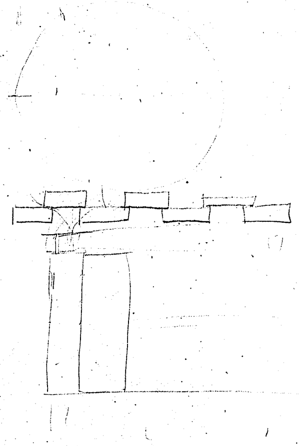

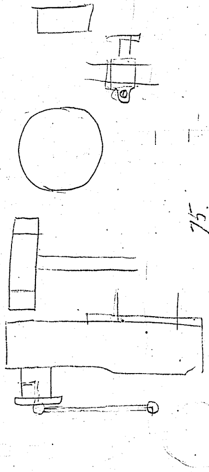

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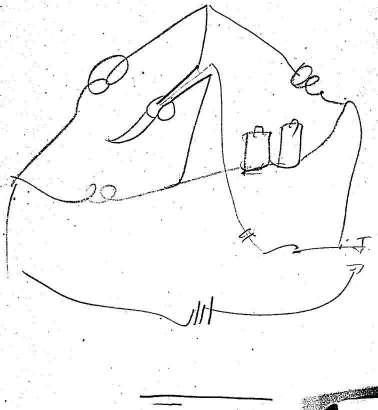

4400

32

$$\begin{array}{r} 40 \\ 90 \\ \hline 3600 \end{array}$$

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25000

6

60

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5

1

[illegible] Goose Goose

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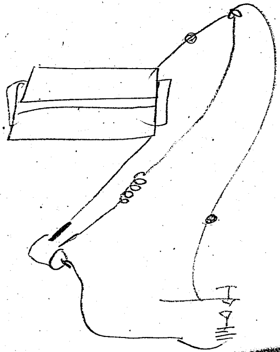

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4400. End 1st year deposit
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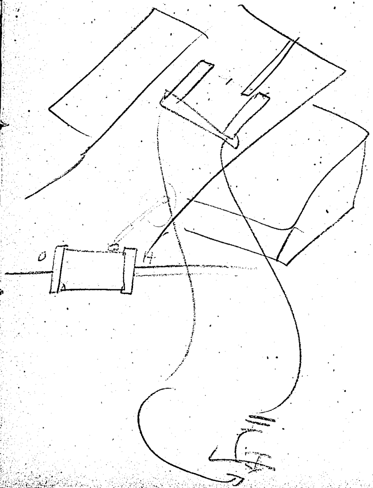

$\frac{1}{3}$

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Kruzi Esq

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Kruzi

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John Kruzi
120

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Professor John Kruzi Esq

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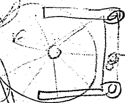
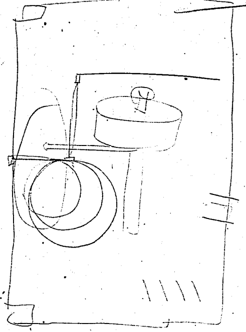
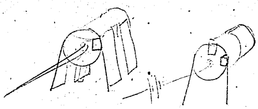
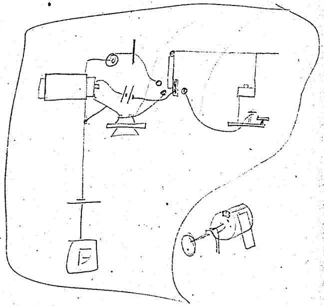
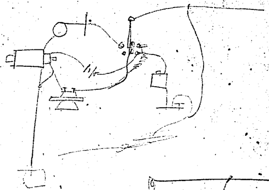


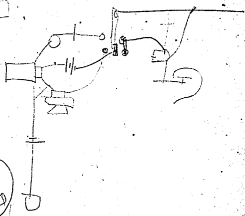
New Receiver Feb 23 1879
Chas Batchelor

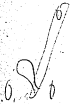


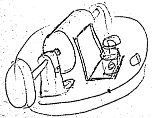




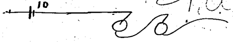


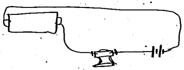


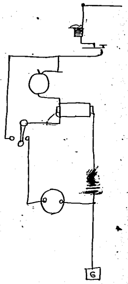


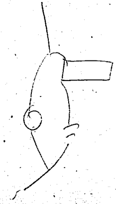


Feby 26, 1879.
T.A.E.









Spiral in vacuum

3-42 P.M. 2 cells

3 51 3 cells

3 55 .. 4 cells

4 00 PM 5 cells

Whitish very good light

405 6

409 7

414 8

420 10 cells

422 11 cells

$3\overline{)26}$

$$\begin{array}{r} 9 \\ 9 \\ \hline 81 \end{array} \qquad \begin{array}{r} 81 \\ 3 \\ \hline 243 \end{array}$$

4½ 2½

$$\begin{array}{r} 6 \\ 6 \\ \hline 36 \\ 25 \\ \hline \end{array} \qquad \begin{array}{r} 45 \\ 6 \\ \hline 270 \end{array}$$

ohms

$3\overline{)26}$ Volts

9 Webers $\begin{array}{r} 9 \\ 9 \\ \hline 81 \end{array}$ Units of Work Energy

$\frac{1}{1}$ = 1 Weber

$\frac{2}{1}$ = 2 W

$\frac{2}{2}$ = 1 Weber

3564

10.692) 33.000 (3.0 lamps
32076
9240

3300, 1

7370) 33000 (4.6 lamps?
29480
35200

46) 100 (2.2
92
80

.33 .22

3 | 26 Volts
9 Webers

March 5, 1879.

9
9
81 = units of Work = 44 ft lbs
3
243 X 44 ft lbs
44
972
972
3 | 10,692
3.564

4 | 26
6.5

6.5
6.5
325
390
42.25 X
4
169.00 X 44 ft. lbs.
44
676
676
2 | 7370
3685

~~2 979) 10.692 (4~~

29) 1.06 (3.2
97
90

297) 737 (2.4
594
1430

237) 3300 (14
237
930

8 Ohms
10
10. (2.6
2.6 Webers

2.6
2.6
156
52
6.76
16
6.76
44.
2704
2704
5(2944
5948
2379.6

1/3.)

10,000.

3600

1

.4,

6)26.
$4\frac{1}{3}$

2 Bath
4

4.33
4.33
1299
1299
1732
18.7489 Units
6
119.44
44
44576
44576
3)49033.6 Total
1634.45 Batting
2)3268.91 Bath Combs
1634.4

114

$5 \overline{)26}$
5.2

5.2
5.2
104
260
27.04
5
20

I can not find the last number of ~~one~~ the Experiments but think it was No; 60

March 7, 1879.

Ex. No. 61. ~~Ex~~ Covered spiral with Magnesia from the Acetate. The spiral was brought up suddenly and melted with ~~seven~~ fresh cells very acid.

March 16, 1879

We was all night bringing up 12 lamps in vacuum worked all day Sunday all night Sunday Night all day Monday

1 lb Coal 6 hp 1 hour

.10

60) 3393.(56
300
393
360
3

33000

60) 359.
6

6

1.74

33000) 12000000 (3393
99000
130000
99000
310000
297000
130000
99000
31000

12
30
360

12 lamp 1000 Rivo

1100 revolut

121)

$10^2 : 11^2 :: 12 :$

121
12
1452

14 lamps

1200 17 lamps

$10^2 : 12^2 :: 12$

144
12
1728

1300 20 lamps

13
39
13
169
12
2006

1400 23 lamps

14
56
14
196
12
2352

1500 27 lamps

15
75
15
225
12
2700

1600 30 lamps

16
16
96
16
256
12
3052

1700 revolution

34 lamps

17
17
119
17
289
12
3468

1800

38 lamps

18
144
18
324
12
3888

1900

43

19
171
19
361
12
4332

2000

48 lamps

20
400
12
4800

2100

53 lamps

21
21
42
441
12
5292

2200

58

22
44
44
484
12
5808

2300
23
69
46
529
12
6348

63 lamps

2400
24
96
48
576
12
6912

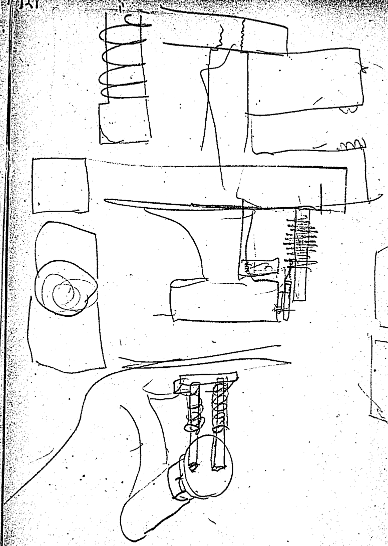
69 lamps

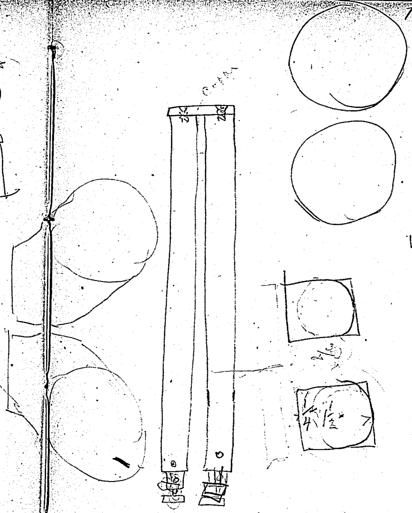
2500
25
625
12
7500

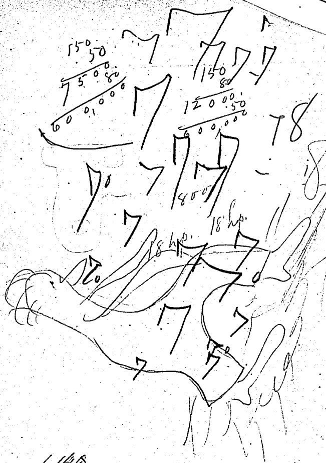
76 lamps

5000
50
2500
12
30000

300







$$\begin{array}{r} 114 \\ \underline{47} \\ 798 \\ \underline{456} \\ 5358 \end{array}$$ 2679

Thermopiles

Iron soft = Iron hard - grey cast iron, white cast iron - casehardened iron - Steel soft = Steel glas hard - Steel to a straw - Steel to a blue, - steel hardened on the copper end - zinc ~~steel~~ cast - Cadmium - Tin - Aluminum Lead, brass white = Common brass, composition, Babbitt metal - Nickel - Copper soft = Silver Bismuth, Antimony - Sulphide Lead, sulphide Tin - Sulphide Iron, Sulphide Bismuth Sulphide Antimony - Sulphide Nickel - Sulphide Copper, Sulphide Manganese, Sulphide Chromium. German Silver - Bell metal = Rose metal - Muntz metal = phosphor bronze Aluminum bronze = Sulphide Mercury Sulphide Tungsten = Pewter = Brittania ware - Carbon - retort = battery = Carre - Wallace - Coke -

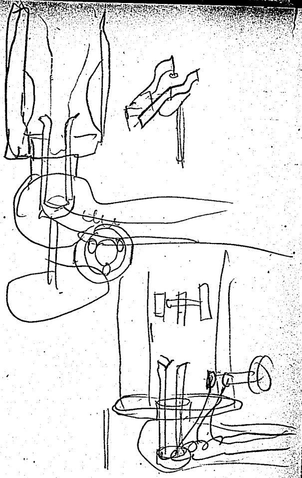
Sulphide Cobalt = Cobalt -
Hyperoxide Lead - Iodide Copper -
Peroxide Manganeese - Iron reduced
by Hydrogen = Sodium amalgam.
Potassium amalgman = plumbago -
Red phosphorous =

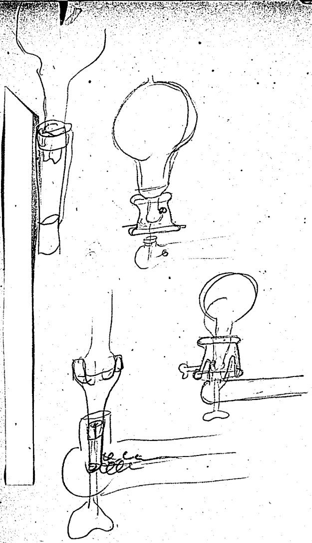
Chas Batchelor

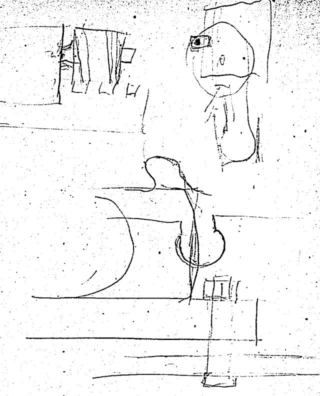
Chalks for Receiver

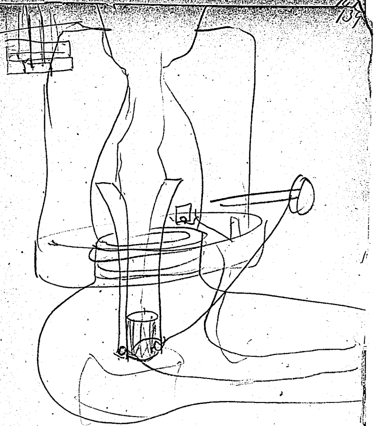
— 12 Oz. pp. Chalk
— 36 grains Mercurous Acetate dissolved in ½ litre water and filtered —
— This solution and Chalk intimately mixed and dried out to thick paste
— Then 2 oz (fluid) of Saturated Solution of Caustic Potash intimately mixed
This was dried & sifted through 100 sieve & pressed

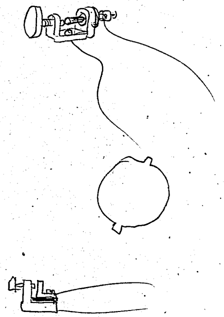
2 — No 1 As much as 3 can press
2 No 2 " " " 2 " "
2 No 3 " " " 1 " —
2 No 4 " " " 1 on short lever
No 5 —— very small

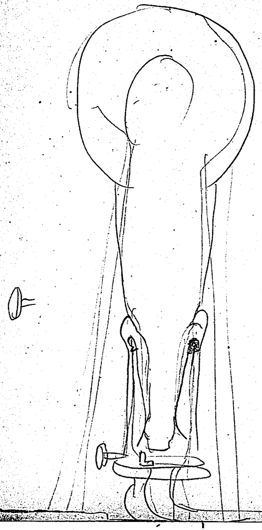








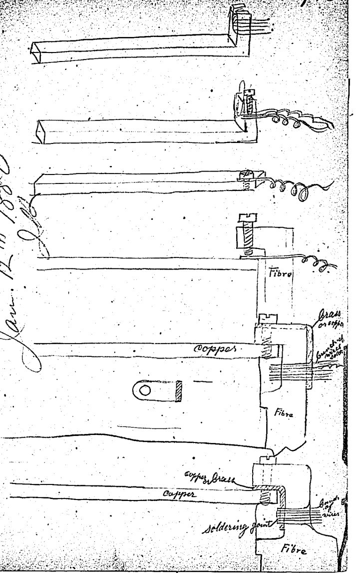




7/8

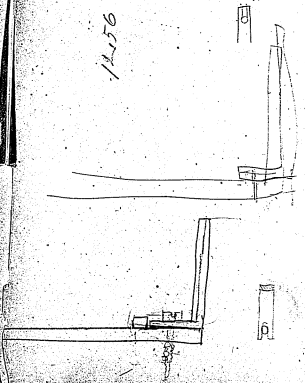
$\frac{6}{2}$

000

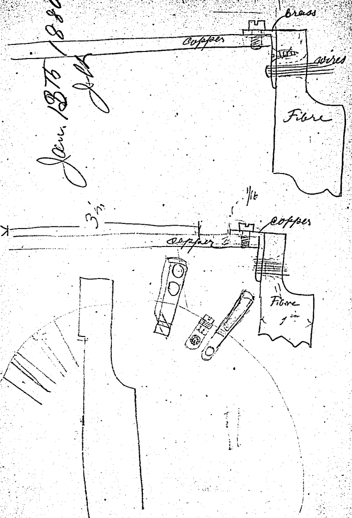


Jan. 12th 1880

12-56



Jan. 1876 / 1880
July

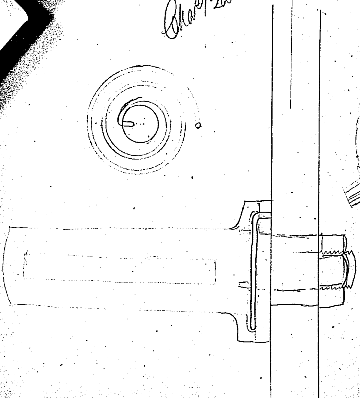


146

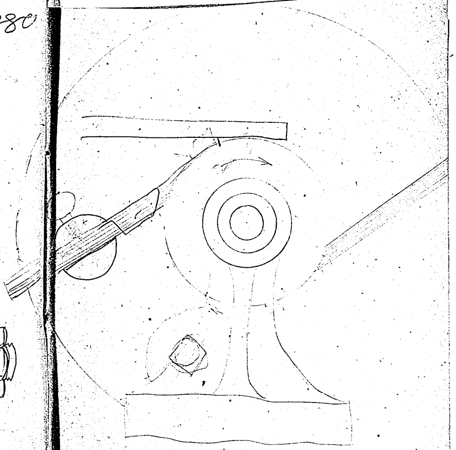
147

Previous to
Jan. 15th 1880

Chas Batchelor



Pages 148 & 149. "Brush Holders."



152

120
6
1020

18
18) 350 19
18
170

48
100

195
2
390

18
5
900

322
644 26
289 44
49 58
1529 352
1124 220
12769 2552

184
5
920

900
28

14 47 31
920 94
28
102
158
1419.82
80
15
940
160
1840
15
9200
1840
27600

54
56
56
122
56
52
122
200
200
32
940

475
160

25

129

133

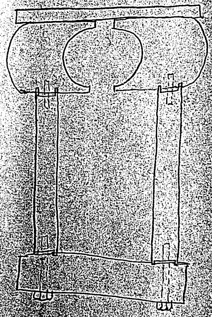
20	1020	1200
112	2000	3000
30	19 —	2800
	19 —	1500
	20	2600
	3	18 —
	15	500
	5	150
	3	700
	$11420	3000
		180
		173.80

M. 20.00
120

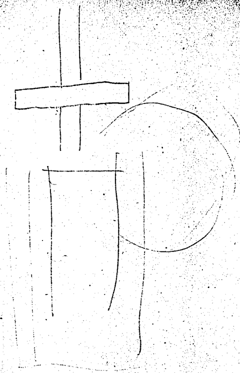
L. $160

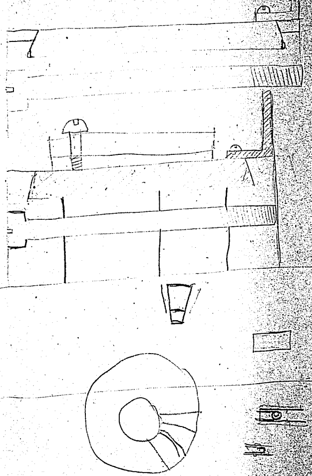
11420
5400
1000
35200
96.00
130.00
4800
31.00
180.00
6000
36 —
196 —
30 —
50
276 —
+20
128

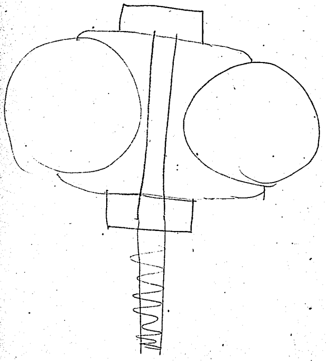
M. $ 1653.00
200
$ 1853

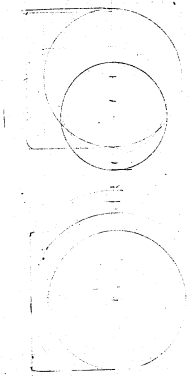


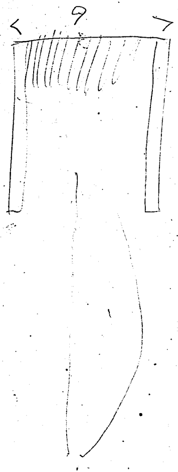
58)22000(380
174
460







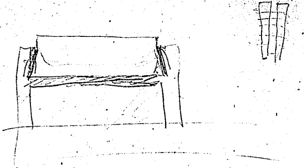




92
43
1/2)135 = 68

19.68

9.75
9.75
20.68
26.00
65.28
24
26.08
130.4
12)156.48 = 130.4
75
6520
9128
9780



775 : 280 :: 22000

280
22000
560000
560

775) 6160000 (8000
6200

125) 30000 (240
250
500

5) 240
4

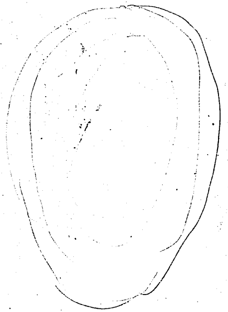
24

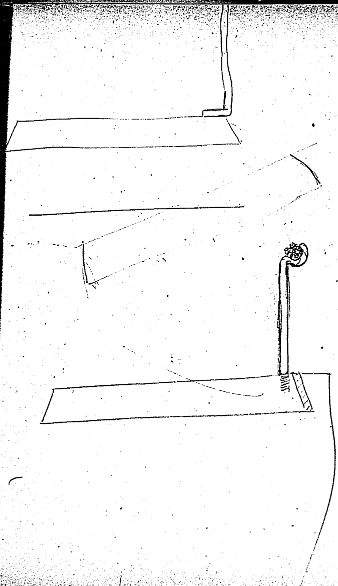
380 3.80

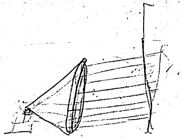
125) 580 (40.6
500
800
750
50

28
8800
13200

125) 13200 (105
125
700





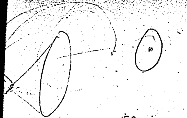


For

15, 53.

Portland

A



6

Prodsham

150
50
7500
80
600,000

5.

55 5 5

A

120

120

Poy 73 7300 A

150
29
1350
300
4350
588
500
348
34800
38280

75

127

15,

129

129

129

110,

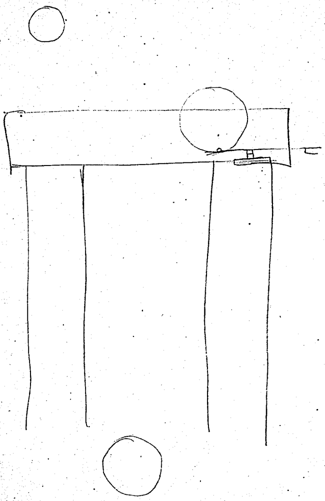
127

127

129

127

168
11.5



$6 \times 6\frac{3}{4}$

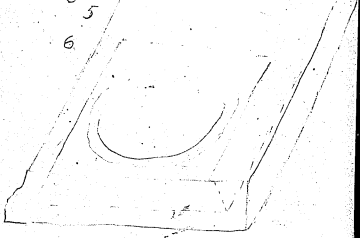
45

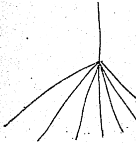
$5\frac{1}{8}$

6

5

6





14) 540

90

57

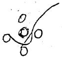
14 8000

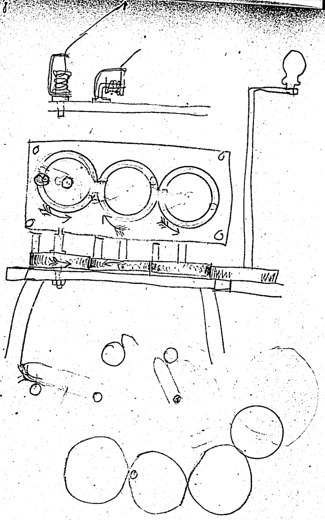
70

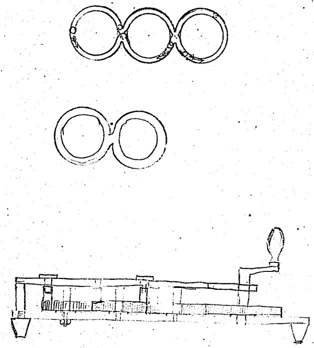
100

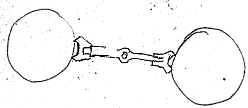
50

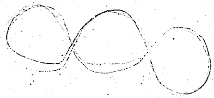
14.









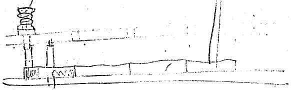


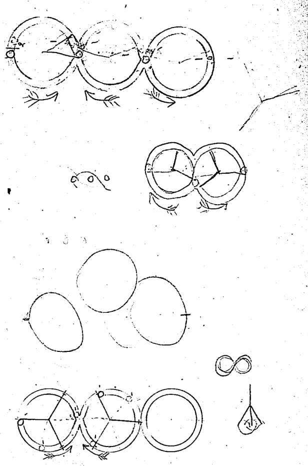
2

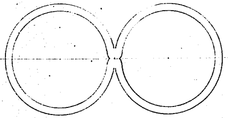
450
66
2700
2700
29.700

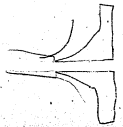
28.90z

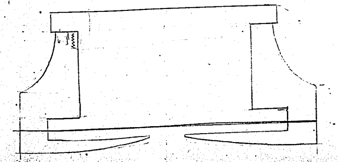
450
58
3600
2250
2610 0











$\frac{1}{2}$

.25 6.28 = .251
128
30

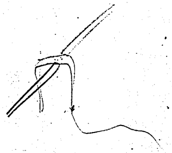
4)6.28 = 1.32
2

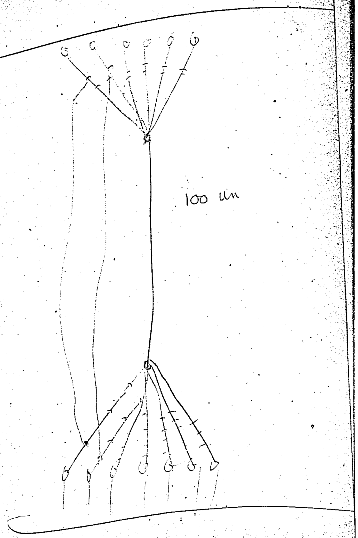
$6.\frac{1}{34}$

$6\frac{1}{4}$ 4.25

= .251

25   25)6.28
.128
30





$.025)\overline{.054}\ (2.16$

1050

40

25

15

012

2.4

.0096

4.6

576

384

.04416

.054

.012 candles face

~~54~~ : ~~44~~ ::

27 22

12

44

22

27)264(9.8

243

210

3/6

50

300

.032

3.025

.032

6050

9075

.096800

2.65

1.325

3.975

.17

27725

3975

.67475

3.975

.674

3.301

~~013~~
25

$$R = \frac{l}{d^2}$$

33000

$$\frac{\begin{matrix}16\\7\end{matrix}}{11.2}$$

Arithmetic $\frac{1}{}$ $\frac{1}{3}$

8, $2\frac{1}{2}$

7

$1\frac{1}{2}\ \frac{1}{3}\ \frac{1}{4}$

1	10	$\frac{1}{2}$	
2	5	$\frac{1}{4}$	
4	2	$\frac{1}{2}$	$\frac{1}{8}$
8	1	$\frac{1}{4}$	$\frac{1}{16}$
16	$\frac{1}{2}$	$\frac{1}{8}$	$\frac{1}{32}$

$\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$

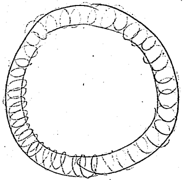
$\frac{1}{4}$ $\frac{1}{4}$

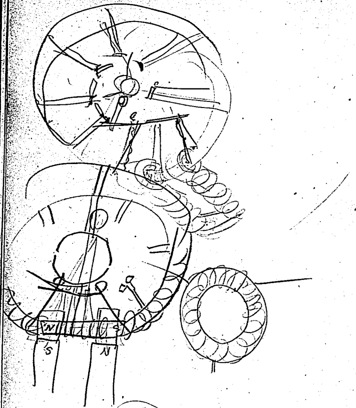
$\frac{1}{4}$

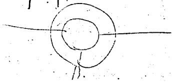
$\frac{1}{16}$

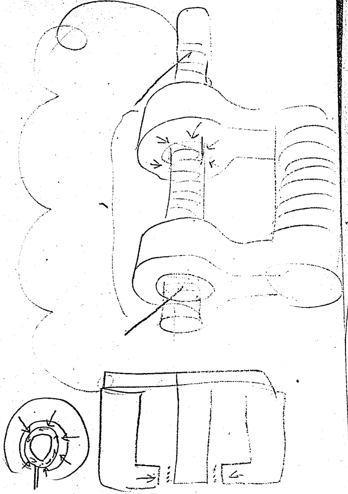
20.

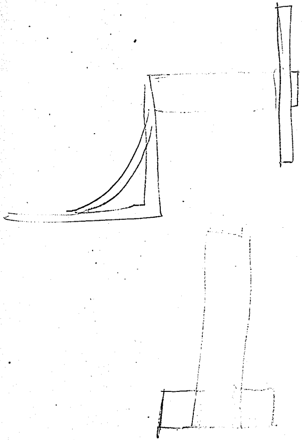
$21/32$ gan olem



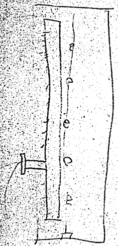

N
S
S
N

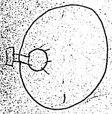






282





Menlo Park Notebook #4 [N-78-12-04.2]

This notebook covers the period December 1878-April 1879. Most of the entries are by Edison, Charles Batchelor, and Francis Upton. There are also entries by John Kruesi, John Ott, and George Jackson. Almost all of the material relates to experiments on electric lighting. There are drawings of lamps, including vacuum experiments; drawings of a machine for insulating spiral filaments; and notes, drawings, and calculations about generators, with a series of numbered experiments cross-referenced to other notebooks. There are also notes by Upton taken from a work by John Tyndall on heat; drawings of telephones; drawings of a blowpipe and of a microscope table; Kruesi's notes on work done to the laboratory buildings; and a memorandum by Edison on scrapbook titles. The book contains 282 numbered pages followed by one unnumbered page.

Blank pages not filmed: 114-115, 164-165, 220-245, 248-279.

Missing page numbers: 143-144, 161-162.

No. 4

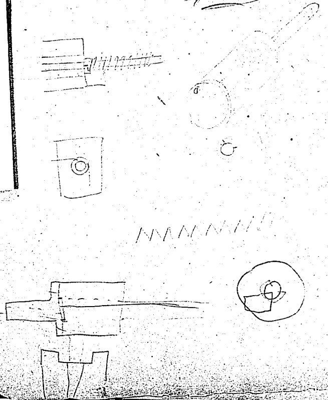
BOARI

Dec 4 1878 1

Electric Light

Chas Batchelor
J Kruesi

Machine for filling spirals with insulating substance
Made by Jackson

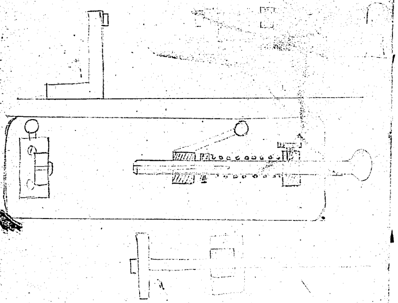


Electric Light Dec 2nd 1878

Chas Batchelor

Instrument for pressing spirals
under heat

J Kruesi



Made by ~~[illegible]~~ 13.

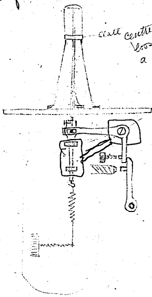
Dec 4 1898

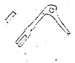
Electric Light Regulator

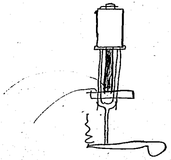
Made by John Ott

Chas Batchelor
J Kruesi

centre wire fits into slate loose but slate acts as a guide





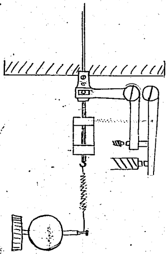


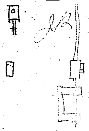
Electric Light

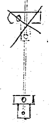
Dec 5th 1878

Chas Batchelor

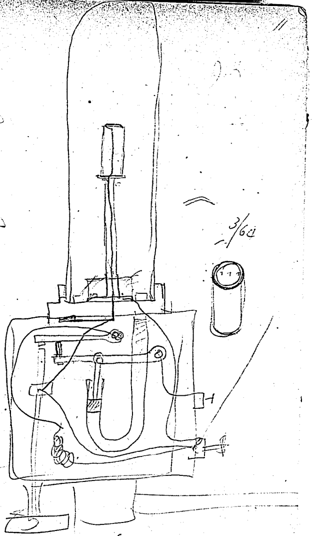
New Regulator







Regulator

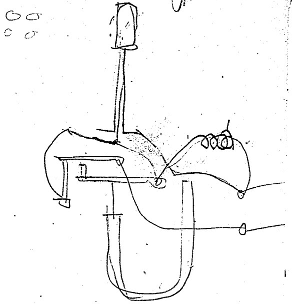


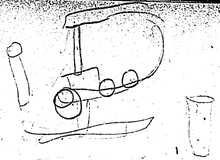
N Boston

Dec 5 1878

Chas Batchelor

Regulator

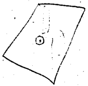




1/50,

1.,

1/8



3/8 x inch., 1 ohm, . 1 h.p.
1/4 . . 6. hp

10,

Portland,
Portland.

Portland Portland Portland

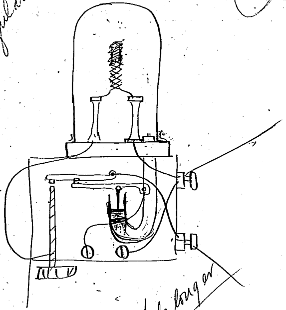
Electric Light

John F Ott

Dec 10th 1878

Chas Batchelor

Regulator



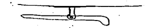
Tube longer

Electric Light Dec 10 1878.

Pneumatic Regulator Chas Batchelor

John F Ott

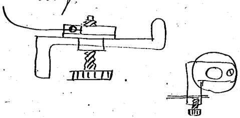
John Ott

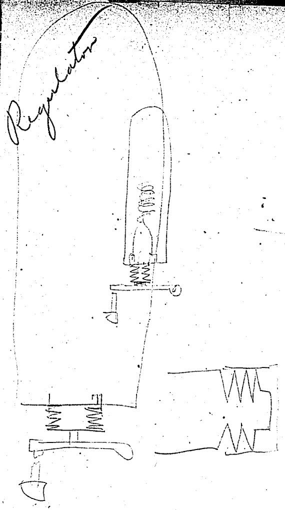
Fasten the 

lever link to diaphragm permanent as the heat softens the wax and lets it come loose.

Insulate the adjusting screw so:

And fasten the wire to it

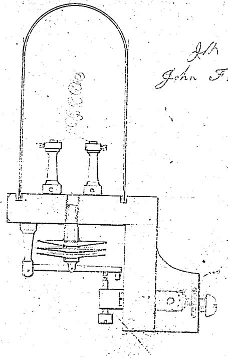



Regulator

22

23

~~D~~ Regulator

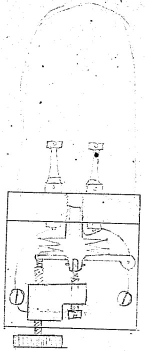


JH
John Ott

EL Regulator

JK

John F Ott



Titles of Scrap books, 27

Electric light.

magneto machines
Lamps
Carbons
Photometric tests.

Magnetism, of Steel bars.
Researches Connected therewith.

Electro magnetism

All researches on electromagnets

Induction (Magnetic)

Induction, Static
of Condensers - plate glass machine

Polarization, including
Secondary batteries,

Galvanic battery,

Thermo Electric Currents,

Conductivity & Resistance
of Matter,

Telephone,

Telegraphy, Fac Simile,

Telegraphy. Duplex Quad.

Telegraphy Automatic,

{Telegraphy. Fire alarm
{Burglar alarm

33,000
600
19,800,000
2,086,000

$\frac{1}{10}$

Horse Power man's power
10 hours
19.800,000 per day ft.lbs.

Man lifting himself on ladder

2,088,000

2.088) 19.800 (9.
18792
0008

Man $\frac{1}{9}$ Horse power raising his own weight.

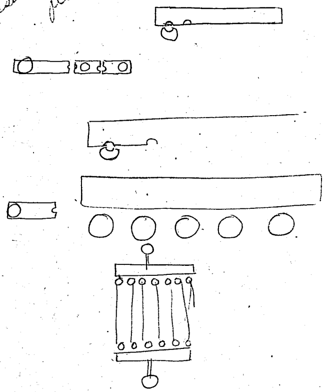
Turning crank or wheel
1,296.000

1,296) 19.800 (15
1296
6840
6480

$\frac{1}{15}$ of a Horse power in turning a crank of a machine.

Resistance coil,
plan of

15
12
180



~~inch~~ inch = 1 ohm G.S wire

.016

21 3/8

.016 Dynamo Edison figures for

Copper = 24.8 feet per ohm

G.S.W. 15.47 times resistance

154) 24.8 (1.61
15 4
.940
924
160

1.61

8) 61
$7\frac{5}{8}$

11) 24.8

~~11~~

~~GS~~ German Silver Wire
.016 when drawn to
double its length
$11\frac{1}{2}$ inches to 1 ohm

A piece Vulcanized fibre
made accurately

5" long
3" wide
$\frac{1}{8}$" thick

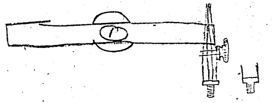
Put in water (Boiling) 1/2 hour
5 $\frac{5}{64}$ long
3 $\frac{5}{64}$ wide (scant)
5/32 thick

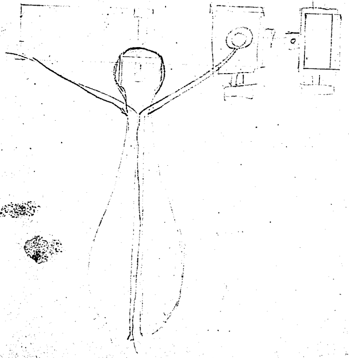
or 5.08
3.07
.15

When cold & dry =

When wet & hot 5 3/16
" cold & dry 5 3/64

For holding wire.





22 | 1880 | 85

188
22
376
376
10 | 4136
413

241.71

146.22

413.6 | 321.71

909.92

531.7

Variable counter shaft

Main	Counter	Speeds of counter
22 in	22	413.6
18	18	241.71
14	14	146.22
10	10	85.00

Counter

413.6 =

22 =	10	909.92
18 =	14	531.7
14 =	18	321.7
10 =	22	188.6

241.71

22 =	10	531.7
18 -	14	310.77
14 -	18	188
10 -	22	110

146.22

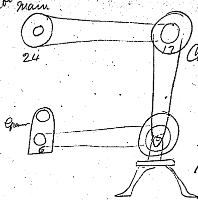
22 :	10	321.68
18 :	14	188
14 ..	18	113
10 .	22	~~10~~ 63.75

85.

22	10	187
18	14	109
14	18	66
10	22	36

This is bad as it gives unequal speeds

(Speed) Countershaft
Variable



Main 188
Counter 376

22 X 10
16 X 16
10 X 22

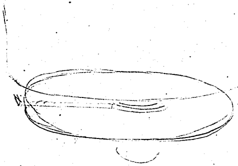
give three speeds on Gramme machine

2068 rev
940 rev.
428 rev

Counter # 376 = Our Machine

Second Counter 15 X 6

22 X 8	= 1034 =	3102
20 X 10	= 752 =	2256
18 X 12	= 565	1695
15 X 15	= 376	1126
12 X 18	= 251	753
10 X 20	188	564



Laboring work

Wrap water pipe from Cistern
To pumps

To digging for setting the trap
tanks & to get to all the pipes.

fill in dig for water pipe
" " " to pond

Dig sewer for the Office
and for water pipe "

Bank up around laboratory

Carpenter work

Put in a new Door in middle room
on South side

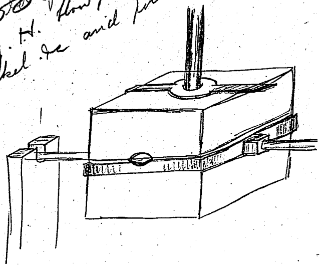
Take sheeting on Front off & put
Tar paper under

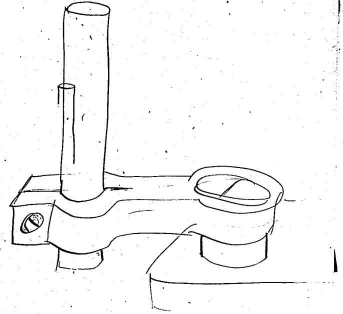
Table for shop

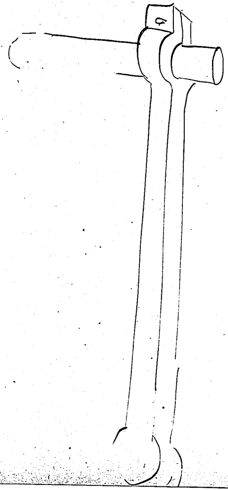
Put in new sink up stairs

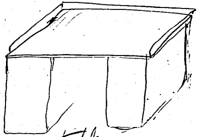
~~[illegible]~~

By J. H. flow pipe to melt
nickel &c and pour in moulds

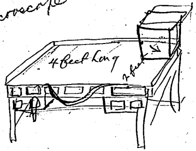





a



Microscope table.



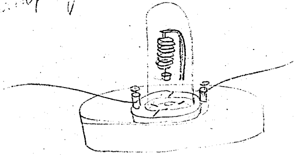
drawers 1 foot long
3 inch deep!

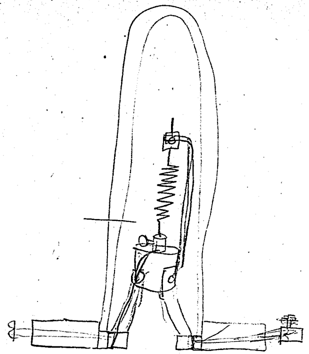
Covered with smooth green Oil Cloth

57

Protochloride

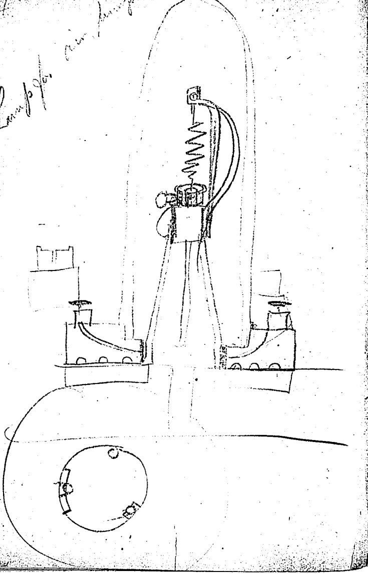
Lamp for air pump



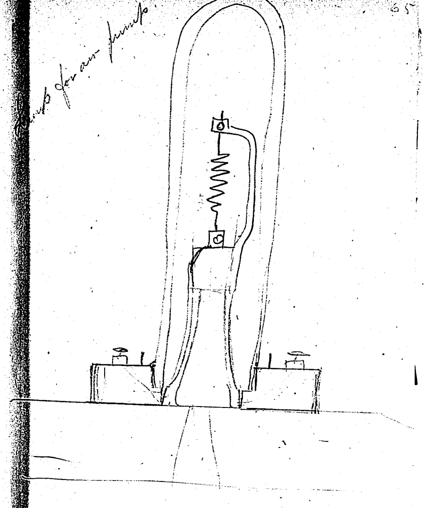


Lamp for air pump

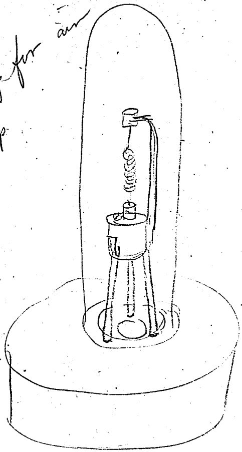
Lamp for air pump

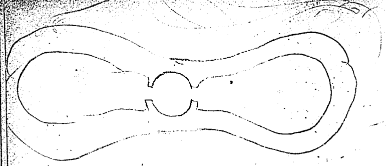


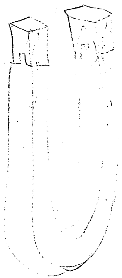
Lamp for air pump

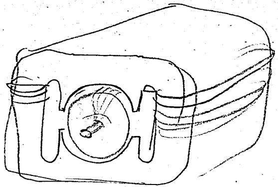


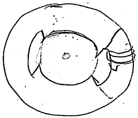
Lamp for air pump.











1

32 20 100

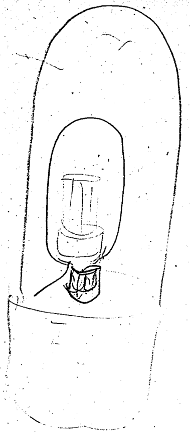
46
4
184
44

8096.

1.50
8
12.00.

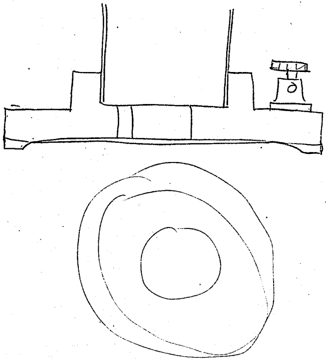
70

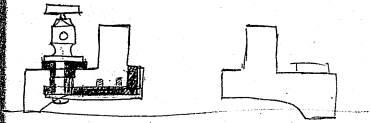
71

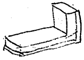


72

73







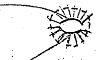
Edisons Magneto Electric Machine Feb 15 1879

Exp. ~~to get the current out of it~~

Book No. 34 Chas Batchelor

Pages 77 to 159" Dynamo Notes, Sketches."
Unimportant.

side and commutator moved round a little each time



There is a slight cross between Coils 0.7 and 0 8

Found this and got it out

The wire that comes through the groove from armature had worked out and was wedged in between the fibre and the shaft this must be covered in next by hard rubber shell as I have done this

Over

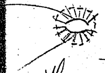
Feb 15 1879

Edisons Magneto Electric Machine

Exp. ~~to get the current out of it~~

Exp No. 34 Chas Batchelor

8 springs connected together on each side and commutator moved round a little each time

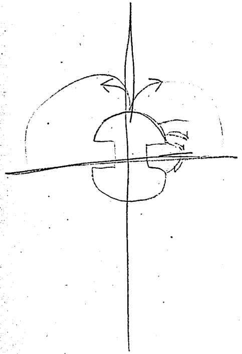


There is a slight cross between coils 0.7 and 0 8

Found this and got it out

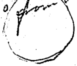
The wire that comes through the groove from armature had worked out and was wedged in between the fibre and the shaft this must be covered in next by hard rubber shell as I have done this

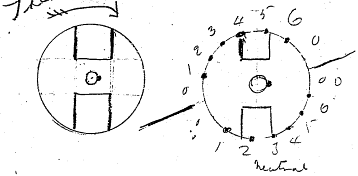
Over



Exp 1

the pole is 90° from where drawn

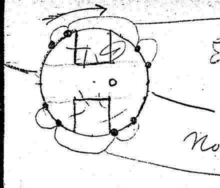




Current quite strong in the commutator

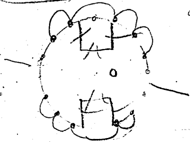
Experiment 35

3 + 4 taken off on each side



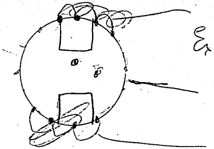
Ex No. 36

No current



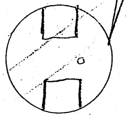
Ex. No. 37

Current



Ex. No. 38

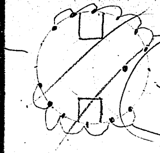
Ex. No. 39



Connected the fixed commutators together so that there are four coils two and two all round

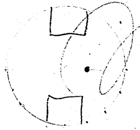
four off of the comms on one side & only 2 on

Ex. No. 40.



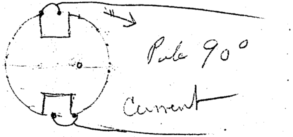
Misalignment

Ex. No. 41.



Commutation
sparking off

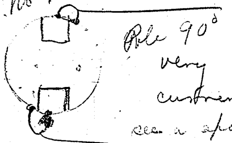
Ex No. 42 Fixed Com 2d L



Pole 90°

Current

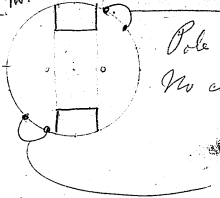
Ex No. 43



Pole 90°
very faint
current hardly
see a spark and
none at the commutator

750 revolutions

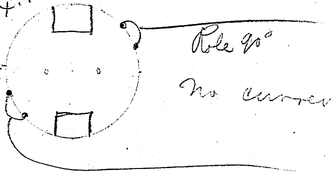
Exp. No. 44 242



Pole 90°

No current

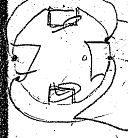
Exp. No. 45



Pole 90°

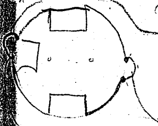
No current

Ex. No. 46 2+2 fixed Com.



No Current

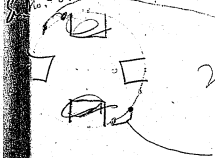
Ex. No. 47



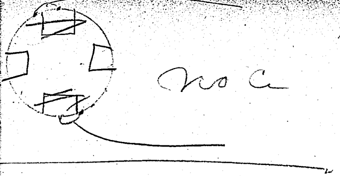
No current

The commutator

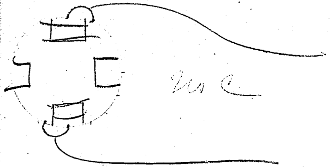
Ex. No. 48.



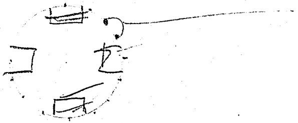
No Current

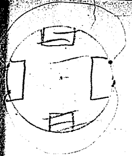


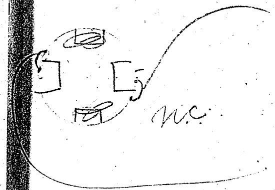
No a

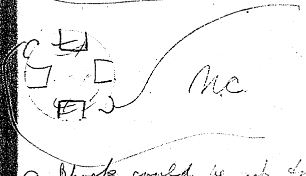


No a

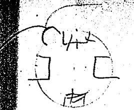




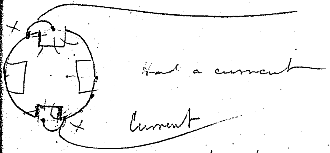




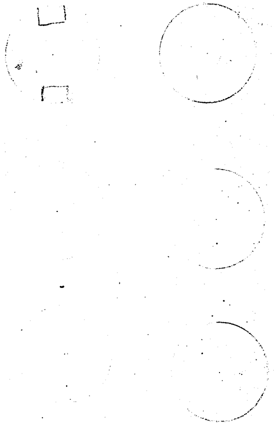
a Shock could be got from the iron to the insulated core



Tried various movements about this so as to get Ex. Nos 1. 2 Tested with current magneto - sounder, found cross between one of the coils and the base.

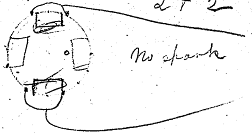


x Last one of the pair [illegible] all the five, was the only one burned.

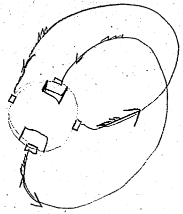


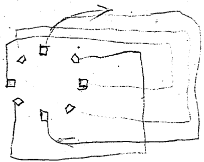
The one wh. breaks the circuit gives the spark.

2 & 2



Connected four and four
four fours.





Battery put on the armature

Coils connected
four and fours

Current through
the commutators for
the most part. The tension
was extremely high as
sparks could be obtained
through the body as a resistance
very slight

104

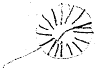
Ex. No. 50 1059

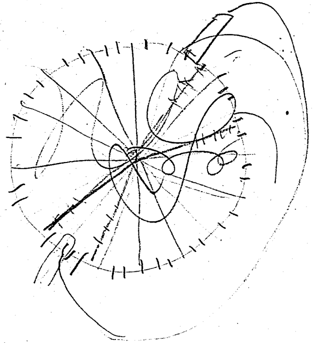
The fixed commutators were fastened in groups of eight and the wires brought to the outside from them. The Gramme machine was then used to run the magnet and a fearful falling was the result as nearly all the currents were short circuited. The sparks on the commutator were very large

Ex. No. 51 One ~~of~~ pair the fixed commutators used and a small arc obtained from carbon pts.

Ex. No. 52 Feb. 16 1879

With one man power, Martin, a fair arc could be obtained from carbon points. A foot of .001 In. Pt was heated. The commutators were connected so that the current ~~was~~ had to pass through four coils. Large sparks were obtained outside the battery being used to make the field magnets.





Ex. 53. The battery current was put from the top ~~and~~ to the bottom commutator piece ~~and~~ of the Gramme and the ring removed. The current is very little from the sides. Perhaps if the battery current were sent through a different coil it would work.

For diagrams of possible connections and some impossible ones for the new dynamo machine see:

Book 7 169–175
9 181
28 1–81

Plan of Electric lesn

Book 9 175

Tyndall estimated the heat given off at white was as 22 times that at ~~below~~ red heat. "Bugs" The radiation from the glass would interfere probably he raised the temp. from low red to White and when white had the radiation from the glass to account for. There there is a much larger amt of heat stopped by the glass at red heat than at White

figured on figure from Prof. Barker Feb 18 1879

figd horsepower is

Capable if it could be

turned all into

Electricity of producing

a current which

would be equal to

730 Daniel Cells

in a resistance of

730 ohms (internal & External)

1 weber = 43 ft. lb

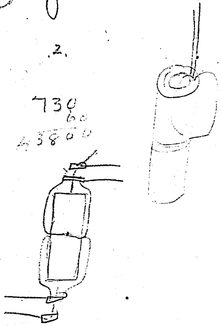
44) 33000 (8
2

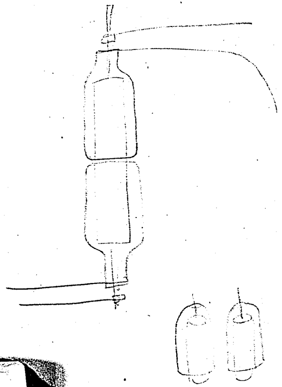
730.

Faraday

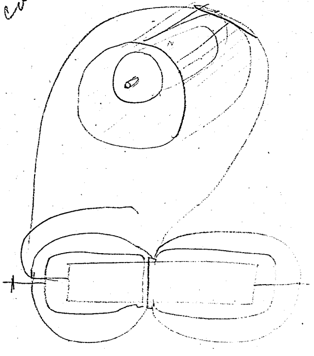
2.

730
60
43800



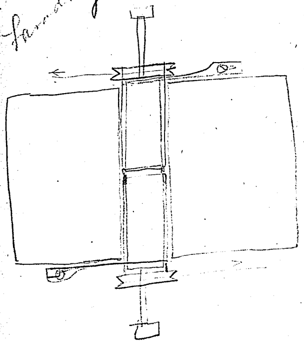


Attempt
No commutator machine



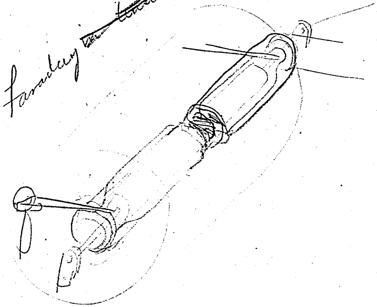
Feb. 19

Faraday

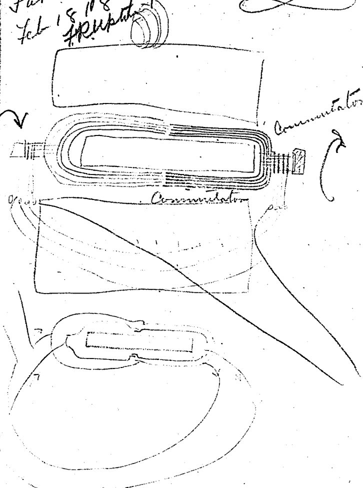


Feb. 19

Faraday ~~[illegible]~~



Faraday machine
Feb 18 1879
F.R. Upton



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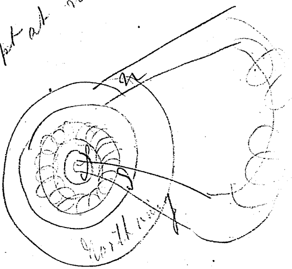
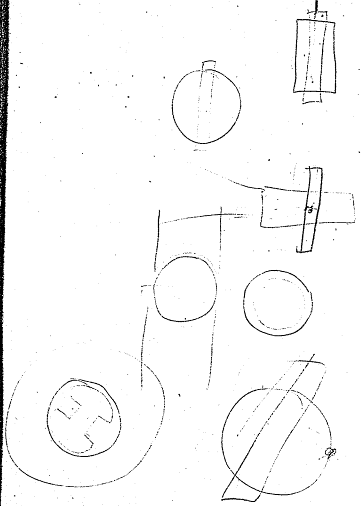
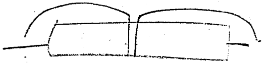
Attempt at no commutator

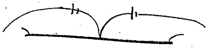


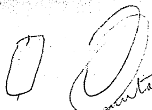
125



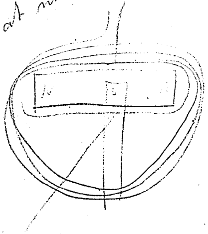
Faraday

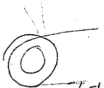




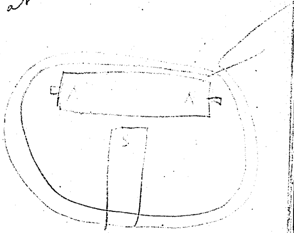


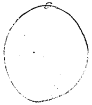
attempt at non commutator

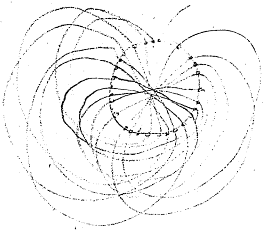




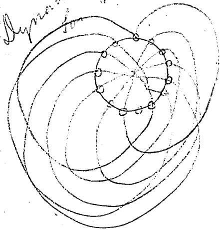
Attempt at non commutator

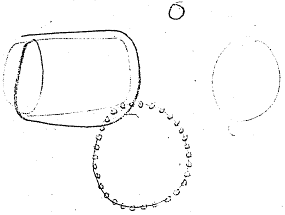




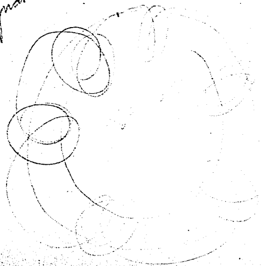


Dynamo for make Gramme and Brush

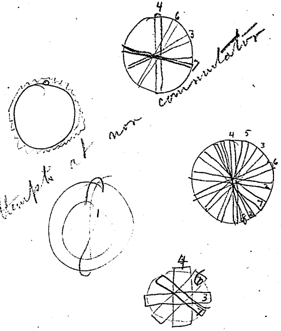




Dynamo

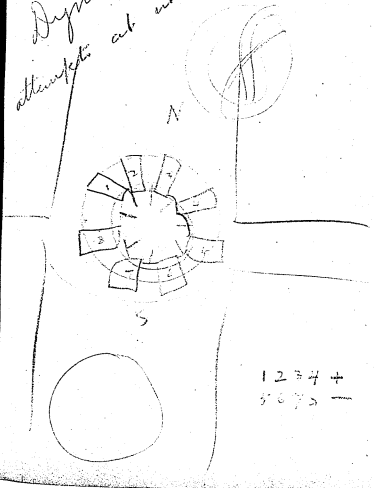


attempts at non commutator

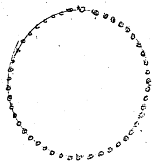


Dynamo mach

attempts at non commutator



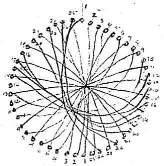
1 2 3 4 +
5 6 7 8 —

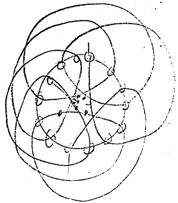


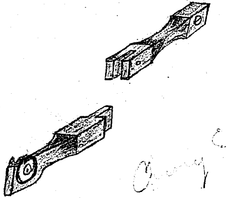
47

5

Diagrama commutator

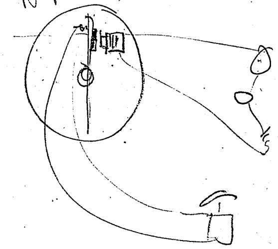


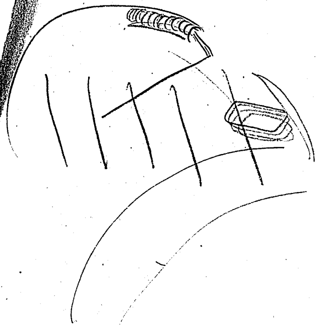




Slot wants to be cut opposite way ~~for~~ as shown in drawing

Dynamo Machine
with magnet





Feb 19 1877

Ex. No. 53 Tried to link up the 56 commutators into seven groups. Did not succeed. See Book   for diagrams

Ex. No 54 Made seven new commutator plates to go over the old

Ex. No. 55. Put the current from the Gramme into the magnet of the Edison and found that the magnet turned much harder.

Ex. No. 56 Put the current into the magnet of the Gramme and found six places where the ring turned a little harder

Ex. No. 57 The current passing through the whole machine gave a strong pull. The hand on the shaft could turn it the other way. Seven cells of battery used, each connected in series.

Ft. 19 Ex. No. 58

~~Insert not~~ Mr. B— tried mixture to close glass to a brass case

For drawings for glass cases &c

Ex. No. 59 Feb. 19

Tried Dynamometre. Found that there was too much friction on the spring. For plan of dynamometre see

~~wanted~~ Mr. E suggested a spiral spring. Then that a magnet be used to drag the bar with it, and the current ~~broken~~ noted at the time when the bar freed.

Ex, 60

The battery put on Gramme and ~~then~~ ring run. Three iron wires heated four feet long. When the Gramme ran its own field three wires very hot, two not as hot and one barely red.

Ex. 61 The Gramme used to run the field of the Edison a ~~[illegible]~~ very strong drag on the belt was [illegible] when the current was put on.

156

1410
21
140
280
12)2940 (241
24
54
48
20

2
482

Ends 189
5
12)945 (79 ft
84
105

34 ft

Feb 20 C. See the Edison
No. 14 .83
5 Armature Edison wound
drum 5

4.97
3.15

3.15
5
.083)15.750 (189.
83
745
664
810

18.9
21
189
378
12)3969 (330
36
36
36
9

330 ft of wire
1/2 Ohm

157

 Wire .75 Ohm

Resistance Gramme

magnet .75 Ohm
ring .60 ohm

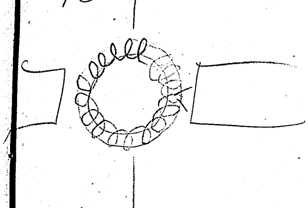
Wallace

16.7
.75

Total 16 Ohms

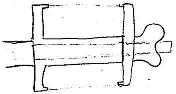
3.3
.75
2.65 Ohms

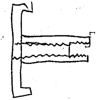
Feb 20 1878

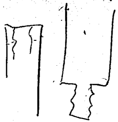


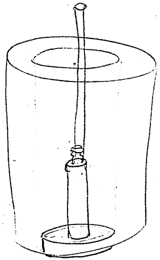
A Gramme ring could be made with one side open, this side could be used for Jablochkoff the continuous side for making the field magnet. E

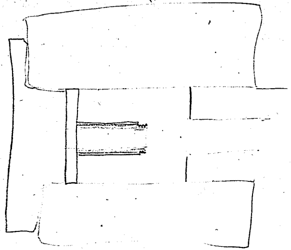
Pages 163 to 175. "Telephone Sketches." Unimportant.

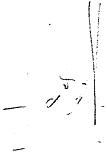


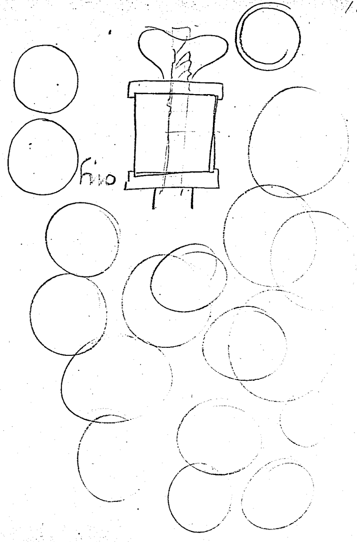








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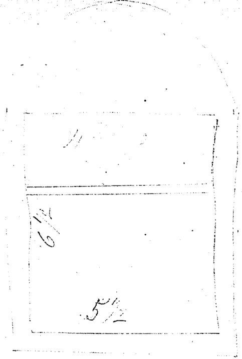
Ohio Round Writing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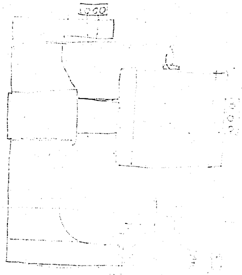
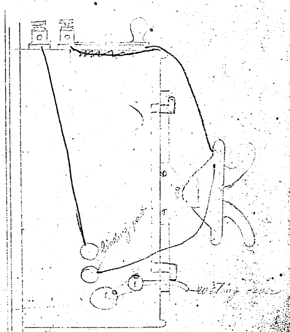


Electro Motograph Telephone

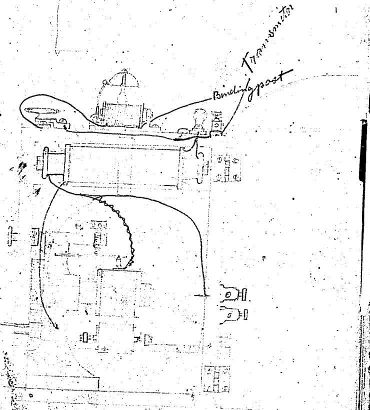
Feb 24th 1879

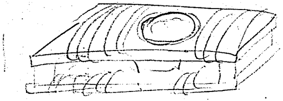


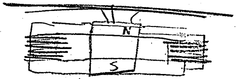
Electro motograph Telephone

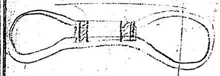
Feb. 24th 1879

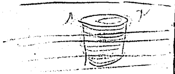
J.K.

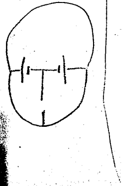


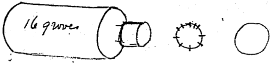


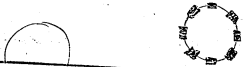


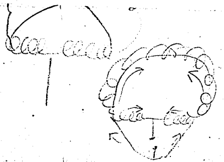










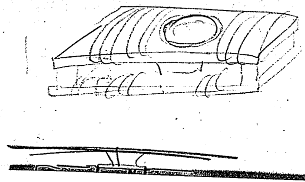


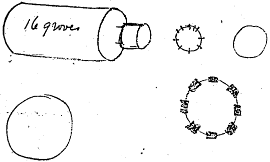
Edison Laboratory Note Book No. 4.

Pages 176 to 181.

Dynamo Machine Sketches.

See Edison Patent:
219,393

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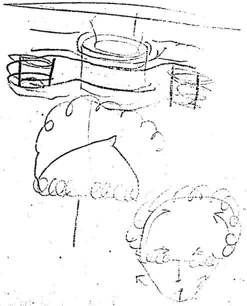

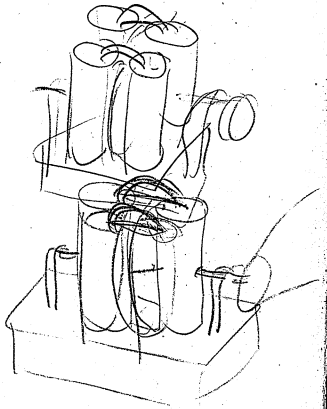

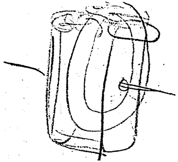

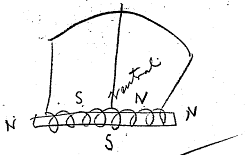

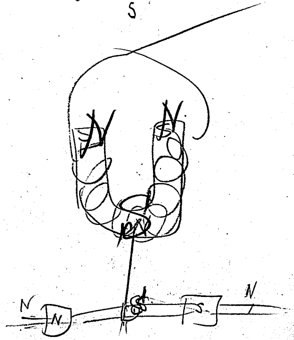

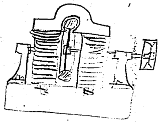

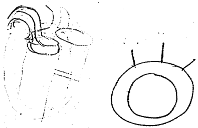

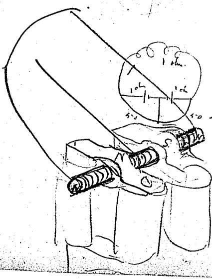

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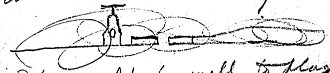
The binding post must be placed as near as possible to the connecting post and the wire fastened to the other connecting post.



It would be well to place the binding post in the place of the screw next to the connecting block

Only one binding screw needed, a hole should be made under it in the wood

Pages 182 to 185. "Old Resistance Boxes extensively use

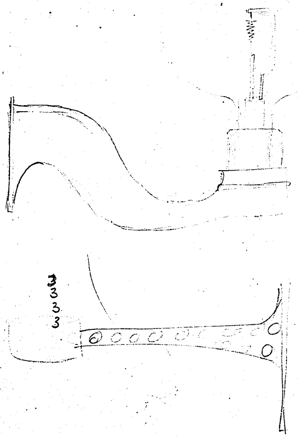
Put binding post in screw hole next to the connection block A. Attach wire to other block B.

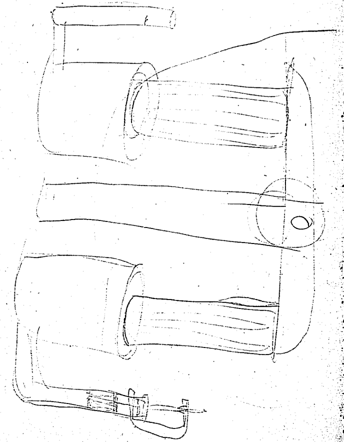
One connection screw C with a hole D under it

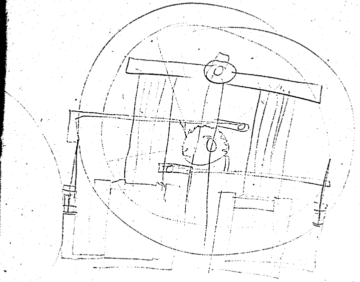
~~Wire from other screw to a large copper wire smaller wire over it~~

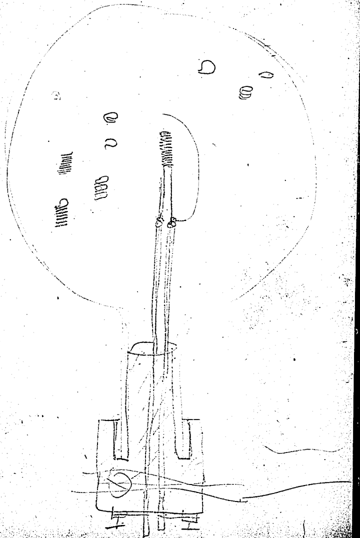
186

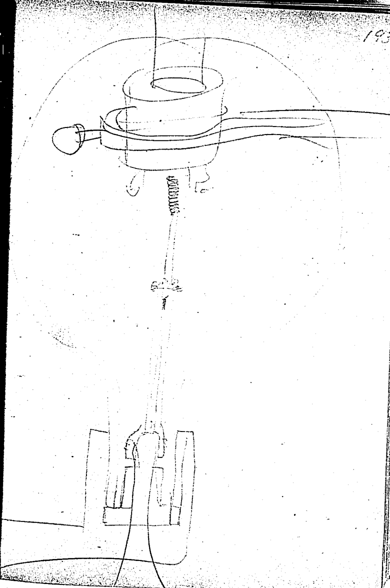
187





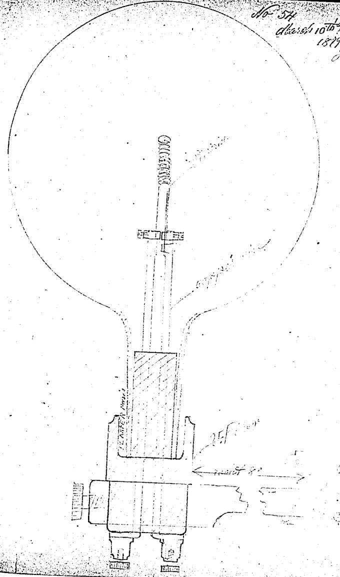


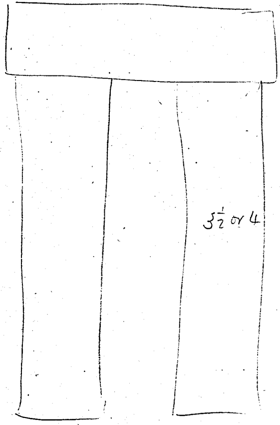




194

No 54
March 10th 9.5
1879
J.K.

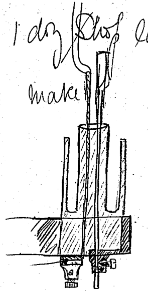


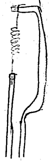

$3\frac{1}{2}$ or 4

198

1 doz Shop lamps

make





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·02
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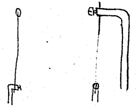
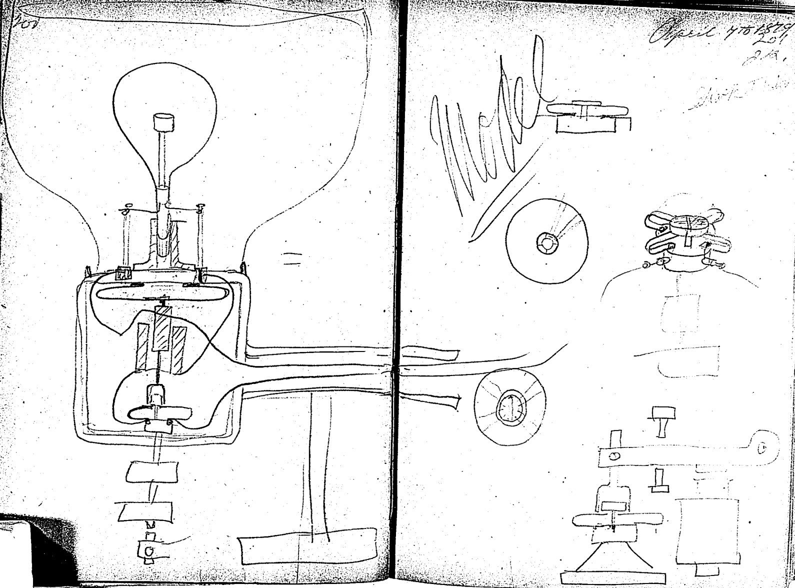
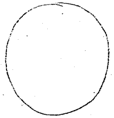
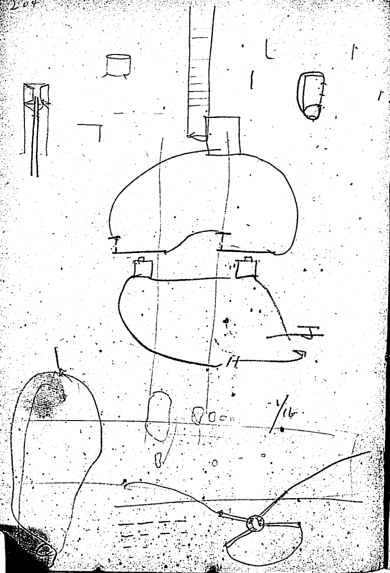
·4375

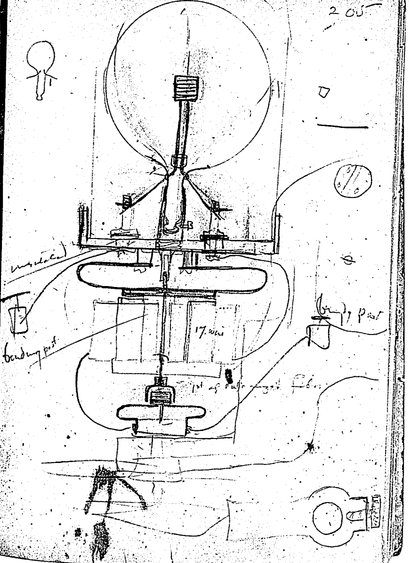


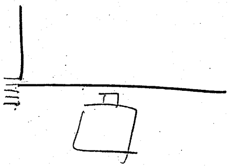
April 4 to 1879
20
2.A.

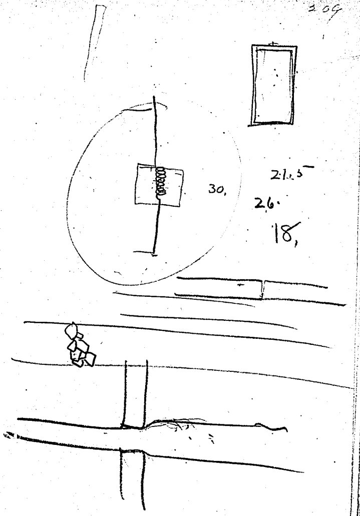





1/16


insulated
binding post
17 wire
binding post




21.5
30,
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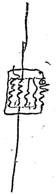

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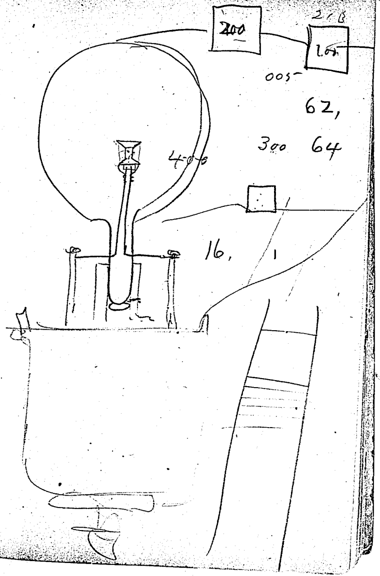
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300 64
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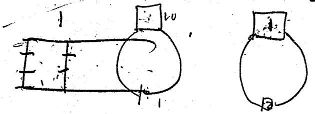
4 .. 1 ohm.

4 in light .5

1 in mach



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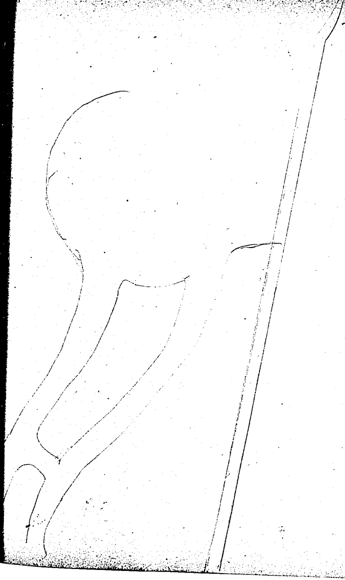

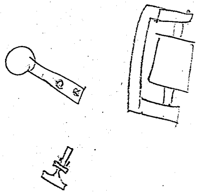

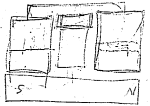
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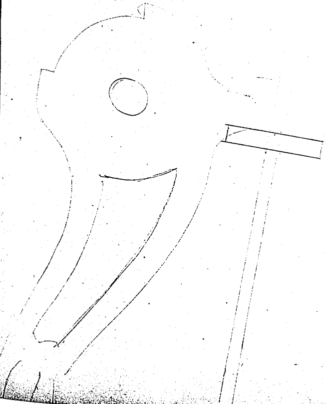
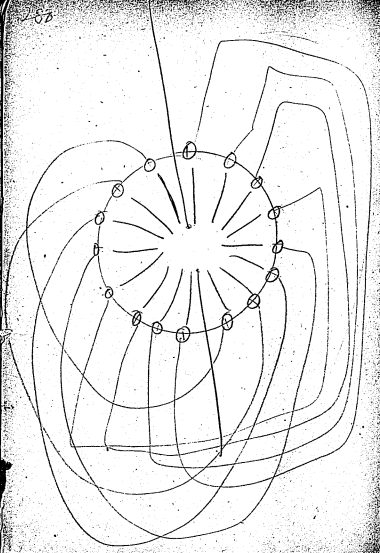
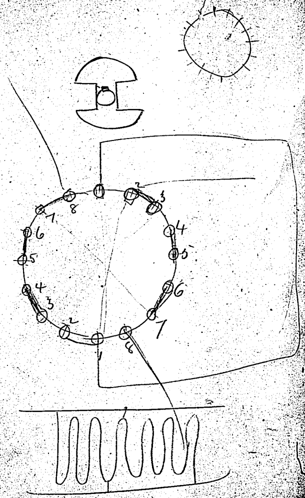
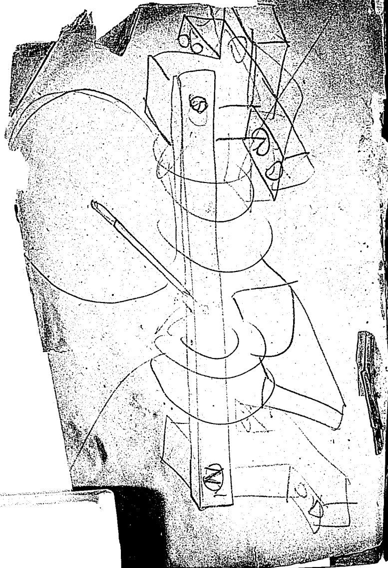








61
6
366 1.83 91
1:82 6
20:125

Menlo Park Notebook #5 [N-78-12-02]

This notebook covers the period December 1878-January 1879. It contains experiments by Edison's nephew, Charles P. Edison, on the electromotograph telephone. The label on the front cover is marked "New Receiver." The book contains 285 numbered pages.

Blank pages not filmed: 6-7, 10-11, 20-21, 24-25, 28-29, 32-33, 36-37, 42-43, 232-233, 250-275, 280-281.

No 5

151
154
155
159
171

1

This note book contains Telephone Experiments and Chemical Tests for telephone experiments, for electromotograph telephone receiver or loud speaking telephone, made in 1878 & 1879, notes made by Charles P. Edison, brother of Thomas A. Edison.

(W. J. H.)

New Receiver — Dec. 2nd 1876
Thos. A. Edison

Experiments with differant mixtures to ~~[illegible]~~ find out differance or change in resistance of Button when left in contact with water

Pleasant Salts

Caustic Potash
Carbonate of Potassium
Sulphide of "
Caustic Soda
Ammonium Nitrate (slightly)
Lithium chloride
Strontium chloride (slightly)
Calcium Chloride
- Aluminium Chloride
Aluminium + Sodium Chloride
Beryllium [illegible]
Magnesium Chloride
Zinc Chloride
Copper Nitrate
Protochloride of Iron
Chloride of Manganese
" " Bismuth

NaO
$NaSO_3$
NaO, SO_3

[illegible]

	when put in proof at	in 24 hours	diff
Pyrogallic + Nitrate Ammonia			
—			
_ Pyrogallic + Nitrate Calcium			
—			
Pyrogallic + Carb Potash			
—			
_ Pyrogallic + Chloride zinc			
—			
_ Pyrogallic + Chloride Ca			
—			
_ Sugar —			
—			
_ Pyrogallic + Sulphate Soda			
8 - pyrogallic + nitrate Strontia			
9 _ Fluoride Calcium. Nit Ammon			
0 - " Nitrate Strontia			
1 - " Sulphate Soda			
" Carbonate Potash		6	

New Receiver Dec 3rd 1878 Chas P. Edison

	When put in stood at	in 24 hr. stood at	difference
3 Fluoride Calcium + Nit. Calcium			
4 " " + Chloride Zinc			
5 " " + Chloride Calcium			
6 Gallic Acid + " "			
7 " Sulphate Soda			
8 " Nitrate Calcium			
9 " Nitrate Strontia			
20 " Carbonate Potash			
21 " Nitrate Ammonia			
22 Powd. Marble " Strontia			
23 " Sulphate Soda			
24 " Carb. Potash			

5 - Powd Marble + Nit Ammonia

6 - " + Nitrate Calcium

7 " + Chloride Zinc.

8 " + Chloride Calcium

9 B. Carb Soda + nit Calcium

10 " + Chloride "

ew Receiver Dec 5th 1878
Chas P. Edison

Damar - Nitrate Calcium no 1 n.c. 5000 N.C N.C

Damar - " " no 2 n.c. 1440 1400 2000

" + chloride Calcium no 1 n.c. 10100 N.C

" " " " no 2 1600 240 1600 1000

5 " Chloride Zinc no 1 130 Busted

6 " (Busted) " no 2 140 B

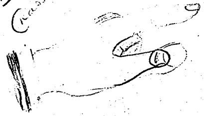
7 " Carb Potash no 1 n.c. [illegible]

8 " " " no 2 n.c. 200

9 " nitrate ammonia no 1 n.c. B

10 " " no 2 n.c. 320 400 700 700

New Receiver
Dec 3rd 1878
Chas P. Edison



[New] Receiver - Dec 5th 1878
Chas P. Edison

1	Daman - Nitrate Strontia	1	n.c.	nc	nc nc
2	" "	2	n.c.	n.c.	n.c.
3	" Sulphate Soda	1	n.c.	nc	
4	Carb Baryta - Nit Strontia	1	n.c.		
5	" "	2	n.c.		
6	" Sulphate Soda	1	n.c.		
7	" "	2	n.c.	500	800 3000
8	" Nitrate Ammonia	1	n.c.		
9	" "	2	n.c.		
10	" Carb-Potash	1	nc		
11	" "	2	nc		

New Receiver Dec 5th 1878
Chas. P. Edison

1	Carb-Baryta-Chloride Calcium	1	N C	500	800 3000
2	" " " "	2	N.C.	1000	
3	" " Chloride Zinc	1	N.C.	2000	
4	" " "	1	N C	2000	
5	" Nitrate Calcium	1		2000	1900 N C 3000
6	" "	2	N C	500	1900
7	Bi Carb Soda "	1	N.C.	N C	
8	" " "	2	N C	N C	
9	" " Chloride Calcium	1	N C	N C	
10	" " "	2	N C		
11	" " Carb Soda	1	N C	N C	
12	" " "	2	N C	N C	1300

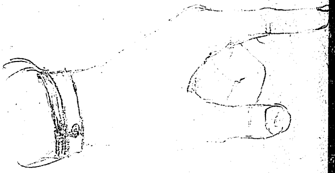
New Receiver - Dec 5th 1878
Chas P. Edison

3 Bi Carb Soda + Nitrate Ammon	1	NC		
4 " " " "	2	NC	100	
5 " " Sulphate Soda	1	N.C.	NC	NC
6 " " " (Busted)	2	NC	NC	
7 " " Nitrate Strontia	1	NC	NC	
8 " " "	2	NC		
9 " " Chloride Zinc	1	NC		
0 " " "	2	N.C.		
1 Camphor + Nitrate Strontia	1.	NC	NC	NC
2 " " "	2	NC	NC	NC
3 " Nitrate Ammonia	1	NC	1100	NC
4 " "	2	N.C.	160	240

27

ew Receiver Dec 5th 1878
Chas P. Edison

71 Camphor & Carb Potash no 1	NC		
" " " 2	NC		
77 B. Carb Soda & Nitrate Calcium	NC	Burnt 160	
78 - Gallic Acid & Sulphate Soda	NC		
79 Flouride Calcium - Sulphate Soda	NC	400 too soft	
80 - gallic acid & Nitrate Ammonia	NC	[illegible]	
81 powd marble & Nitrate Strontia	NC	460 too soft	
82 Flouride Calcium - Nit ammonia	NC		
83 Powd marble - Sulphate Soda	NC	NC	
84 powd marble & Nitrate Calcium	NC		
85 pyrogallic ac " "	NC		
86 gallic acid & Nitrate Strontia	NC	43	soft Burnt



New Receiver Dec 5th 1878
Chas. P. Edison

BiCarb. Soda - Chloride Calcium	NC	30	Soft
powd marble + Nitrate Ammonia	NC	26	Soft
" " Chloride Calcium	NC	80	Soft
pyrogallic acid + Nitrate Strontia	NC	too soft	

New Receiver Dec 6th 1878
Chas. P. Edison

Sugar - Nitrate Strontia - 1	NC	2000	NC
" Nitrate Ammonia 1	NC	too soft	
" " 2	NC		
" Carb. Soda 1	NC		
" " 2	NC		
" Chloride Zinc 1	NC		
" " 2	NC		
" Chloride Calcium 1	NC		

New Receiver Dec 6th 1878 39

T A Edison

[illegible] Sulphate Magnesia + ~~Chlo~~ Nitrate Calcium		N.C.	2000	
[illegible] " " + Chlorides "		3000	40	110 / 120
[illegible]1 " " Sulphate Soda	1	NC	70	100
[illegible]2 " " Chloride Zinc		400	32	200 / 100
[illegible]3 " " Bi Carb Soda		NC	120	200 / NC / 170
[illegible]4 " " Nitrate Strontia		NC	87	[illegible]
[illegible]5 " " Nitrate Ammonia		75		
[illegible]06 Phosphate Lime Nitrate Strontia	1	NC	NC	NC
107 " " — " "	2	NC	NC	NC
108 " " Carb Potash	1	NC	NC	
109 " " " "	2	NC	44	
110 " " Nitrate Ammonia	1	NC	90	27 [illegible]
111 " " "	2	8000		
112 " " Sulphate Soda	1	NC	600	120 good
113 " " "	2	NC	50	Ropy Rusty

Received Dec 7th 1878
Chas Edison

14 Phos Lime & Nitrate Calcium	NC	600	
15 " " Chloride Zinc 1	39	20	Soft Bust
16 " " " " 2	28	20	Soft Bust
17 " " Chloride Calcium 1	NC	~~600~~	~~700~~
18 " " " " 2	24	20	Soft Bust
19 Bermuda Arrowroot " 1	NC	NC	NC
20 " " " 2	NC	800	1000
21 " " Nitrate Calcium 1	NC	NC	NC
22 " " Sulphate Soda 1	NC	NC	
23 " " " " 2	NC	1000	
24 " " Chloride Zinc 1	NC	too	soft
25 " " " " 2	NC		
26 " " Nitrate ammonia 1	NC		
27 " " " " 2	NC	too	soft

New Receiver Dec 7th 1878
Chas. P. Edison

128 Burmuda Arrowroot - Nit Strontia	NC	NC	NC
129 " " " " 2	NC	NC	NC
130 " Carb Potash 1	NC		
131 " " " 2	NC		
132 Snuff Nitrate Ammonia 1	1000	600	
133 " " " 2	300		
134 " Nitrate Strontia - 1	Pu[illegible]		
135 " Carb Soda	too soft		
136 " Sulphate Soda	NC		
137 " " 2	NC	~~[illegible]~~ Soft Burned	
138 " Chloride Zinc 1	NC	60	Soft
139 " " " 2	80	400	[illegible]

New Receiver Dec 9th 1878
Chas. P. Edison

140- Snuff + Nitrate Calcium	400	15	soft
141 " + " " 2	to	Soft	
142 " " Chloride Calcium	NC	110	soft
143 " " " " 2	Busted		
144. Dextrine- " " 1	to Soft		
145 " " " 2	140	soft	
146 " Nitrate Calcium	NC		

Dec 10th 1878

147. Nitrate Ammonia	NC	Bust	
148 Carbonate Soda	to soft		
150 Nitrate Strontia	110	Soft	
151 - Dextrine Nitrate Strontia	NC	NC	
152 " " " 2	NC		

New Receiver Dec 10th 1878
Chas. P. Edison

153	Dextrine & Sulphat Soda		nc	
154	" & Supl Soda		nc	nc
155	" Chloride Zinc		nc	nc
156	" " "	2	Rogr	
157	Carbonate Soda		140 [illegible]	
158	" " "	2	[illegible] rogr	
159	" Nitrate Ammonia		nc	nc
160	" " "	2	nc	nc
161	Bk, ox, Mang & Carb Potash		[illegible]	
62	" " " " "	2	514 rogr	
63	" " " Nitrate Ammon	1	nc	Revd

New Receiver Dec 10th 1878

Thos. A. Edison

163 BK Ox Mang - Chloride Calcium 2	200	polar Soft
164 " " " " " 2		Lo soft
165 " " Chloride Zinc	90	Soft
166 " " " " 2		Lo soft
167 " " Nitrate Strontia	NC	Rusted
168 " " " " 2	NC	Soft
169 " " Nitrate Calcium	NC	3000
170 " " " " 2		Soft
171 " " Sulphate Soda	NC	1400
172 " " " " 2	NC	

New Receiver Dec ~~~~ 12th 1878 Cf. 6

Chas. P. Edison

) Tried experiment with button made of Ferrid cyanide Pottassium one half, Chalk one half - And small amount of Caustic Soda -- did not work) could not hear it

---

Made saturated solution Caustic Soda such as in Rock. and made button of chalk with strong Solution also one of Woodbridge Clay with same solution

---

—

New Receiver Dec 12 1878

Chas P. Edison

Button of woodbridge
Clay - Caustic Soda after being in box 24 hours is non Conductor

Button of Chalk and Caustic under same conditions measured 3000 ohms res.

[redacted]

Make button for receiver of Sulphate Magnesia and Sulphate Soda

#

Button of Sulphate magnesia and Sulphate Soda with about half Chalk -

New Receiver Dec 12 1878

Chas P Edison

Button of sulphate magnesia and Sulphate Soda with small amount of chalk —

---

testing button Sulphate Soda Sulphate magnesia with about half chalk is an non conductor, put in box No 200 —

Testing button Sulphate Soda Sulphate magnesia with little Chalk - is non Conductor put in box for testing No 201

New Receiver Dec 12 1878
Chas. T. Edison

Phosphate Lime and Sulphate Soda Button receiver Size

—

—

Phosphate Lime with strong solution Caustic Soda

—

Chalk Button for Receiver with Solution Sulphate Soda

—

New Receiver Dec 13th 1878

Chas. T. Edison

Button Rec. Chalk, Sulphate Soda - Acetate Mercury

Woodbridge Clay, Sulphate ~~mercury~~, Soda, Acetate Mercury,

---

New Receiver Dec 13th 1878
Chas. T. Edison

Experiments with Mercury Salts for conductivity

Sulphuret Mercury (black) Good Conductor

Hydrarg. Oxid. nigr - Non Conductor

Bi chromat Mercury, Very slight -

Iodide Mercury. good conductor Some Times other times not at all test it again

---

Bromide Mercury Non Conductor

Cyanide Mercury - gives 4 degs with heavy pressure on No 1 coil

---

Cyanat Mercury Non Conductor

New Receiver Dec 13th 1878
Chas. P. Edison

Experiments Mercury Salts "Continued"

#

phosphor oxydulat Mercury - Non Cond

—

Bi Iodide Mercury - Non Conductor

—

Hypophosphate Mercury - Non Conductor

—

Protochloride Mercury - Non Conductor

—

~~Proto Nitrate Mercury~~ -

—

thin button sulphuret Mercury
gives no motograph action

—

New Receiver Dec 13th 1878

Chas. B. Edison

the button of Carb baryta. Sulphate Soda + Acetate Mercury when heated ~~x~~ and dry felt 3000 ohms

the above is good

New Receiver Dec 14th 1875
Thos. A. Edison

Sulphate Magnesia and BiCarb Soda ~~no~~ Motograph Effect

Phosphate Lime & Sulphate Soda
Very Good Motograph Effect

testing button No 200 ~~two~~
put in Box last night tried
this morning and had good
Emg Effect—

New Receiver Dec 14th 1878

Na_2SO_4 Chas P Edison

202 — Sulphate Magnesia, Sulphate Soda and about 1/2 chalk
No 202 - 24 hours in Box nonConductor
no Emf Effect

203 Sulphate magnesia + Na_2SO_4
in Box 24 hours Non Conductor
No Emf Effect

4 $Ca.CO_3$ + Na_2SO_4 + Hg $\bar{a}$
24 hrs is 10,000 ohms fair Emf Effect

05 Ca_2PO_4 + Na_2O
24 hours in Box 460 ohms Emf Effect good

206 Ca_2PO_4 + Na_2SO_4
about 15000 ohms No Emf Effect

New Receiver Dec 14th 1878

Chas P Edison

Na_2SO_4 - $CaCO_3$ Slight Conductor
after being in box 24 hrs - no Eng Effect

208 - $MgSO_4$ + Na_2SO_4 - slight Conductor
after being in box 24 hrs - No Eng Effect -

209 Na_2SO_4 + Hg $\bar{a}$ + Woodbridge
Clay - Has Eng Effect before putting in box

Dec 15th 1878 CPE

No 209 after being in box 24 hrs
is 1000 ohms res - Note - when
first put up to ~~test~~ it
tested 5000 ohms and decreased
steadily until it reached 1000 ohms
Can feel Motograph Effect but
faint -

New Receiver Dec 15th 1878

Chas. Edison

No 205 – (Ca, powdered nag, so₄ is bang up for
Eng Effect after being in box 24 hrs
work good two Cell Callaud —

— # —

Carb Baryta Acetate Mercury
and Sulphate Soda has bang
up Eng effect after being in
box 24 hrs – No 2 15

New Receiver Dec 16th 1878
Chas. P. Edison

No 202 ~~[illegible]~~ tested after being in box 36 hrs. is only slight conductor.

203. tested after being in box 36 hrs is but slight conductor. [illegible] 4 days [illegible] no electromotograph effect.

New Receiver Dec 16th 1878 - Chas. T. Edison

No 204 - after being in box 36 hrs. 66 but slight Condr - showing 4 degs -
Small Emg Effect -

No 205 - stood on Saturday 14th [illegible]
put in box down stairs by [illegible] and
stands at 920 ohms this morning
~~Small Emg effect~~ -
Emg Effect good [illegible] this is
as good as [illegible]

New Receiver — Dec 16th 1878 T. A. Edison

No 206 — 36 hrs in box slight Condr — Showing 3 degrs — very small Eng. effect —

No 207 36 hrs in box slight Condr Showing 2 deg — small Eng Effect.

208 — 36 hrs in box slight Condr — Showing only one degr —

209 36 hrs in box — 3 sec after [illegible] on [illegible] [illegible] [illegible] no Eng effect —

+

Now Received Dec 16th 1878
Chas. P. Edison

Button of Phosphate Lime.
Acetate Mercury - Sulphate Soda
finely mixed - Measures 6000 ohms
and gives Bang up Emg Effect —

No 1212

Button Chloride Lime
Acetate Mercury and
Sulphate Soda - is bang
up for Emg Effect - Measures
1000 ohms resistance
this is the best button yet in
[illegible] Motograph
has been standing 6 hrs in
open air and works bang up
one I held over light until
it was hot and then worked
just as well —

New Receiver Dec 16th 1878 83

Tho. A. Edison

Button no 210 of Chloride Lime
Acetate Mercury with a little
chalk to stiffen is a little
to soft wants more Chalk

Button 211 Chloride Lime
and Phosphate Lime no Eng
Effect — think it is to wet
wants more Phosphate Lime

New Receiver Dec 17th 1878

Chas. P. Edison

Button 212. which worked good last night after being left out all night has about 15000 ohms resistance this morning and very little Eng Effect - after cleaning surface of button. the Eng Effect is much better - and when wet is as good a last night.

Button 210 under same conditions about same resistance and Eng Effect is N.G.

Button 211 same conditions measured 1400 ohms resistance and Eng Effect is N.G.

New Receiver Dec 17th 1878

Chas. P. Edison

Button 205 has stood out 48 hrs and conducts very little Emo Effect small —

Button 205 after being wet slightly works splendid with 2 cells Carland —

Sulphide Calcium - Chloride Silver Acetate Mercury - shows off good conductor but galvanizes and Emo Effect is poor gets better when wet

New Receiver Dec 17th 1876

Chas P Edison

Experiments to determine Conductivity of different Chemicals —

Experiments tried with 6 Cells Callaud on no 1 coil —

Arseniate Manganese, slightly —

—

Sulphate Silver — Slightly —

—

Lunar Caustic — Non Conductor

—

Sulphuret Silver, ores — Non C

—

Red Sulphuret Antimony — Non Cond —

—

Acetate Silver — Non Conductor

—

Carbonate Bismuth — Non Conductor

New Receiver. — Dec 17th 1878 91

T. A. Edison

Acetate Lead - Very slight Cond

Lactate Bismuth - Non Conductor

Bromide Silver Non Conductor

Bismuth Hydr Nitric - N.C.

Hydrarg, Oxydat, flav. Prace - N C

Carbonate Silver - Very lightly -

Oxide Silver - — Very small -

Cyanide Silver - Non Conductor

New Receiver Dec 17th 1878

Thos A. Edison

Sulphuret Tin. Good Conductor

Bismuth Valerianic - Non Condr

Antimon - Diaphoretic - N.C.

Protoxide Antimony - Slightly -

Mangan Hypophosphorous - Conducts a little. Shows Tc Cy.

Bisulphuret of Tin - Fair Cond shows Tc decomposes -

~~Tungstic acid~~

New Receiver Dec 17th 1878

Thos. A. Edison

Tungstic Acid — when tested without weight is non Conductor with moderate pressure it increases Conductivity untill it is 700 ohms resistance and by taken pressure off ~~gre~~ is N.C. again

Alibium sulfurat Amt — N C

Sulphuret Antimony. N C

Plannum Sulfurat. N.C.

Carbonate of Lead — N.C.

titanic Acid — Slightly Cond

New Receiver Dec 17th 1878

Thos. A. Edison

Protochloride Tin - Very good

Plumbum Chlorat, Cryst. N.C.

Chromate Lead - - N.C.

Plumb Phosphorus N.C.

Cadmium oxidat - Very good

Tannate of Lead - N.C.

Iodide Lead - N.C.

Sulphate Lead N.C.

Mangan - Phosphor - N.C.

New Receiver Dec 17th 1878

Chas B Edison

Plumb. Carbonic = NON CONDUCTOR.

Hypophosph Iron - ditto

Phosphate Iron - ditto

Chromic acid 140 ohms no pressure

Borate of Copper Non conductor

Sulphuret Copper - No conductor

Acetate Nicol - Non Conductor

Carbonate Manganese - Non Cond

New Receiver Dec 17th 1878

Thos. A. Edison

Bichromate Lead - NON CONDUCTOR -

Acetate Copper. cryst - Non Conductor

Subsulph Iron - Non Conductor

Titanic Acid - Non Conductor

Valer Iron - Non Conductor

Succinate Iron - Non Conductor

Carmine - NON Conductor

Sesquichloride Chrome - 140 ohms resistance without ~~[illegible]~~ pressure and no resistance with pressure

New Jersey Dec 18th 1878

Chas. P. Edison

Cuprum Oxydulat - Non Conductor
Cuprum Arsenicic - " "
Chromate Copper - " "
Cuprum oxydat " "
Chlorat Cuprum _ 9000 ohms resistance
Iodide Copper No resistance

Cupri Cyan: Non Conductor
Cuprum Oxalic ditto
Formate Copper ditto
Sulphate Cobalt Non Con
Nitroprussia Kupper - Non Con
Natrum Formicicum - Non Conductor

New Receiver Dec 18th 1878

Chas P. Edison

Mangan Boracic - NON CONDUCTOR

Protoxide Nicol - ditto

Ferr. Tannic - Non Conductor

Tartrate Iron - Very Slight (cant measure it)

Cobalt Carbonic Very Slight

Nicol Carbonic - without pressure shows about 16.000 ohms with pressure decreases to 4000 ohms

Nicol oxidic - Non Conductor

Alumina (pure) Non Conductor

New Receiver Dec 18th 1878 107
T. A. Edison

Iron Arseniate - Non Conductor
Ferrum Acetic Sicc - ditto

Protoxide Iron - ~~do~~ very slight
Conductor ~~without~~ pressure
(could not measure it showed only 2 deg.) but
with pressure resistance was
reduced to 3000 ohms

Uran Nitric 1100 ohms resistance

Uran Kalium Acetic Non Con

Lactate Iron Non Conductor

Iron by Hydrogen see next page

New Receiver Dec 18th 1878

Chas. P. Edison

Iron by Hydrogen — without any pressure shows 2 degs Equal to about 15000 ohms. and with pressure there is no resistance whatever — by taking pressure off goes to 15000 ohms again. Can show any resistance by pressure —

Iodide Iron — Non Cond

Urani Sulfa — 200 ohms res this one is wet

Urani Nitric — Non Conductor

Ferri Ammon Citras — Very Slight —

NEW RECEIVER December 18th 1878 111

Charles P. Edison

Iron Oxalate - Non Conductor

Pyrophosphate Iron - Non Cond.

Cerium Sulfuric without pressure 4000 ohms - with pressure 600 ohms.

Baryum Hyposulfuric - Non Cond

Iodide Baryum - 4000 ohms - moist -

Valerianate Magnesia - Non Conductor

Lactate Zinc - Non Conductor

New Receiver Dec 18th 1878 113
Chas P Edison

Phosphat of Lime Non Conductor

Aluminia Acetaate. — N.C.

Sulphate Strontia N.C.

Oxalate Strontia — N C

Carbon of Lime - N C

Acetate Lime Very, Very, Small

Phosphate Aluminia N.C.

Oxalic Cobalt Non Condr

New Receiver Dec 18th 1874

Chas P Edison

Carbonate Zinc non Conductor

Acetate Zinc non Conductor

Alumin Sulfuric Non Conductor

Sulphate Lime non Cond

Tartaric Magnesia non Cond

Magnesia Sulfite non Cond

Calcium Phosphat slightly +

New Receiver Dec 18th 1878

Thos A Edison

Chlorate ~~"~~ Strontia — without pressure 12000 ohms with pressure 4,400 ohms

—

Acetate Strontia Non Conductor

—

Carbonate Strontia Non Conductor

—

Baryum fluorat very slight

—

Strontium hydric Non Conductor

—

Sulphuret Barium without pressure about 2000 ohms with pressure 4,400 ohms

New Receiver Dec 18th 1878
Chas. P. Edison

Baryum Chloricum N C

—

Carbonate Baryta N C

—

Acetate Baryta N C

—

Phosphate Magnesia N C

—

Corydalin N C

—

Fluoride Calcium N.C.

—

Hyperoxide Baryta N C

New Receiver Dec 18th 1878.
Chas P. Edison

Zinci Cyanur - Non Conductor

Chinate Lime non conductor

Sulphate of Lime non Cond.

Quinidine Sulphate - Non Conductor

Picrotoxin - N.C.

Amygdaline - N.C.

Bismuth Lactophosphate NC

Bromide Cadmium NC

New Receiver Dec 18th 1878

Chas P Edison

Valerianate Zinc — Non Conductor

—

Tartrate Potash 2600 ohms — dry

—

Nitrium bi carbonica non Cond

—

Sulphate Potash non Condr

—

Nitrate Mercury 6000 ohms

—

Citrate Potash shows 6 degs

—

Molybdate Soda Non Conductor

—

Stannate Soda Non Condr

—

Carbonate Cadmium Non Condr

New Receiver Dec 18th 1878
Chas. F. Edison

Chromate of Potash — 9 degs.

Citrate Soda non Cond

Soda Fluoridium — Non Cond

Oxalate Soda Non Conductor

Tungstate Soda N. C.

Ferrocyanide Soda, Very slight

Phosphate Soda Non Cond

Sulpho-Carbol Soda — Non Con

Chlorate Soda shows 6 degs
with pressure

New Receiver Dec 18th [12] 1878

Chas. P. Edison

Hyperoxide of Lead - perfect Cond.

Tannate of Zinc - Non Cond.

Cobalt Oxydat - see next page

Cadmium Sulfurat N.C. -

Natrium pyrophosph N.C.

Bromide Sodium N.C.

Oxalate Cerium N.C.

Bisulphate Potassa N.C.

Sodium Sulforinate N.C.

Cadmium Sulfate N.C.

129

New Receiver Dec 18th 1878
Chas Edison

—

Cobalt Oxydat— without pressure shows 1 deg
on gal, 240 ohms with pressure

#

Chloride Zinc — N.C.

—

Sulphate Zinc N.C.

—

Sulpho Carbonate Lime, N.C

—

Bromide Cadmium N.C.

—

Sodium permangan gives 4 deg
without pressure 1700 ohms with pressure

New Receiver Dec 18th 1878

Chas. P. Edison

~~Zinc ferro~~

Zinc ferro cyanat – without pressure gives 5 dep. – with pressure 4400 ohms

---

Lithium Carbonic – N.C.

Natrium Benzoic Non Conductor

Bi-sulphate Soda without pressure 1300 – with pressure 410 ohms

---

Cadmium Chloride 170 ohms with out pressure – damp

New Receiver Dec 18th 1878

Chas. P. Edison

Natr Sulpho Carbonic. slightly shows 5 deg.

#

Manganate Soda. Slightly. Very Little

#

Crocus Antimony No Conducn

Iodimmo nitro prusside. Non C

Nitrate Soda. Non Conductor

Hyposulphite Soda Non Condr

Hypophosphite Amon 400 ohms
damp

New Receiver Dec 18th 1878
Chas P Edison

Patassium - N.C.

Kalium Bi-Carbonic N.C.

Iodide Sodium 100 ohms
NaI turns it red by current damp

Binoxalate Patash slightly
shows 2 degs

Oxalate Patash - Non Conductor

Antimonate Patash 740 ohms
slightly damp

Bisulphate Patash N.C.

Sulpho-Carbotate Pattassi NC

New Receiver Dec 18th 1878 137
Chas. P. Edison

Valerian Ammonia N.C.

Nitrate Potash. slightly. 3 degs

Ammoniac Sulphide N.C.

Chloride Potassia N.C.

Ammon Urii Non Conductor

Anthracate of Potash 740 ohms
Wet

Tartrate of ammonia N.C.

New Receiver Dec 18th 1878
Chas. P. Edison

Kalium Carbonic 470 -
no dery moist -

Chromati Patassa 6000 ohms

Sulphate Amonia slightly
7 days

Kalium Hypermangan N.C.

Tungstate Ammon N.C.

Succinate Ammonia N.C.

Ammon Uric N.C.

Cyanide Patassium

New Receiver Dec 18th 1878

Chas P Edison

Phosphate Potash N.C.

Chlorate Potash. N.C

Antimoniate Potash. 800 ohms

Kati Hyperchloric N.C.

Phosphate Ammonia. N.C

Caustic Baryta : N.C

Chrom oxydat N.C.

Cinnabar — N.C

Brucin — N.C

New Receiver - Dec 18th 1878
Chas. P. Edison

Asparagin - Non Conductor

Brown Aniline Non Conductor

Caffein Valerianic Non Cond

Beryll - oxydat Non Conductor

Caffein sulphuric Non Cond

Asarone Non Conductor

Yellow Aniline Non Con

Ammon Boracic Non Con

New Receiver Dec 15th 1878
Chas P Edison

Ammon Citrate _ non Cond

Ammon carbazotic non Condr

Opocynin non Cond

Ammon Bi Carbon non Condr

Hydrobromate Ammonia N.C.

Ammon Gallic non Condr

Antimon Heper non Condr

Bebeerin Muriate non Condr

Gum Benzoe non Condr

New Receiver Dec 18th 1878

Chas P Edison

Aniline Green Non Cond.

Red Aniline. Non Cond

Berberin Sulph. Non Con

Berberin (Pure) Non Con

Molybdate Ammonia - N.C.

HydroJodate Ammonia N.C.

Blue Aniline. Non Cond

Bitter nut Shucks Non Cond

Bromin Non Cond

Citrate of Caffine Non Cond

Alloxane Non Cond

New Receiver - Dec 18th 1878
Chas. P. Edison

Iodide Ammonium - Very Slight
Benzoate Ammonia Non Con
Caryaphylli Non Cond
Caffein Non Conductor
Baptisin Non Conductor
Alloxanton - Non Cond
Caseine Non Cond
Lycopodium Seed N.C.
Bimalic Ammonia N.C.
Aloin N.C.
Cerium Oxydat N.C.

New Receivr Dec 18th 1878
Chas P Edison

Turmeric Non Conductor

Cantharides Vaica Non Cond

Napthaline N.C.

Mannite N.C.

Palmetitic Acid. N.C.

Piperine N.C.

Molybdaenic Acid without pressure shows 5 degs with pressure 800. ohms

Narcotine. Non Conductor

Menispermin Non.C.

Chlor. Propylamin NC

Cinchonidia NC

Quinidine NC

New Receiver Dec 18th 1878 153
Chas P Edison

Lupulin Non Conductor
Cinchonidin sulph N.C.
cinchonin N.C.
Chinin Valerianic N.C.
Morphine N.C.
Chinic Acid N.C.
Quinine Acetate Slightly 3 deg
Quinine Arseniate Non Condr
Cochineal No good
Quinine Tannate Non Condr
Quinine Bromide Non Condr
~~Malic Acid~~
Jalapin Pur. Alb. N.C.
Morphiae Murias N.C.
Glycochol N.C.

New Received Dec 18th, 1878 (5)
Chas P. Edison

Strychnine Nitras NC

Morphine Valerianate NC

Morphiae Bi Mecon NC

Quinine Citrate NC

Quinine Ferrocyanide NC

Cinnamylic Acid NC

Quinine Iodide NC

" Hypophosph NC

Elaterium NC

Hippuric Acid NC

Glucina carb NC

Cubebin

Digitalinum Pur NC

New Receiver Dec 18th 1878
Chas P Edison

glycyrohizine N.C.

Quinine Lactate NC

Santonine NC

Theine NC

Acet Strychnia NC

Sulph Strychnia NC

Iodide Strychnia NC

Quinine muriate NC

Uric Acid NC

Thymol NC

Ultramarine NC

New Received Dec 18th 1878
Chas P Edison

Uric acid NC

Veratrine NC

Urea Pura NC

Strychnia NC

Saponin NC

Santonine NC

pepsine NC

Proteine NC

New Receiver Dec 19th 1878 161

Chas P Edison

Foliated Tellurium 70 ohms resistance

+

Carbazotic ~~Acid~~ Non Conductor

+

Camphoric Acid - N.C.

+

Carbon trichlor. crust.

+

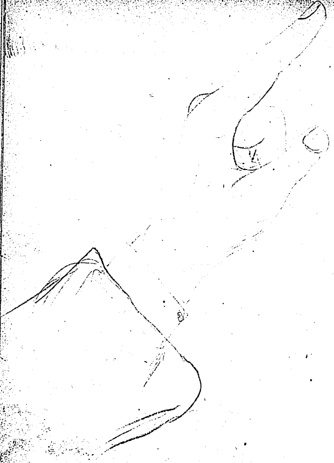
Phosphor Amorph. soft

—

trichlor Carbon cryst. N C

~~Tellur~~

Selenium Non Condr



New Reading Dec 19th 1878
Chas P Edison

Iodic Acid _ 70 ohms X dry

Iodide Sulphur Non Cond

—

Gum Myrrh Non Cond

—

Phosphate Lime . Non C

—

Grape Sugar N.C.

—

Gum Kino N.C.

—

Sulphate Soda 300 ohms

—

Litharge _ non Cond

—

Brazil Wood N.C.

New Receiver Dec 19th 1878
Chas P Edison

Gum Benzoin N.C.

Gum Sandarach N.C.

Oil Mace - pressed N C

Gum Tragacanth N.C.

Gum Olibanum N C

Tannin Non C

Gum Zanzibar non C

Gum Arabic non C

Madder non C

New Receiver Dec 19th 1878
Chas P Edison

Paris Green — Non Conductor

Scotch Snuff N. C.

Iceland Moss N C

Gum Dammar N C

Arsenic Acid N. C.

Milk sugar N C

Gum Guiacum N C

Bi Carb Soda N. C.

159

New Receiver DEC 19th 1878

Chas P Edison

Grape Sugar Non Conductor

Dextrine Non Conductor

Cocoa Butter Non Conductor

Asbestos non Conductor

Gum Ammoniac non Condr

Chlor Potass non Conductor

Bermuda Arrowroot Non Cond

Camphor non Conductor

New Receiver Dec 9th 1878
Chas. P. Edison

Salt Peter Nonconductor

Animal Charcoal shows 5 degs

Gold ore non conductor

Asphaltum Non Conductor

Borax - Non Conductor

Alum - Non Conductor

Sal Ammoniac non Conductor

Rotten Stone - non Conductor

New Receiver Dec 19th 1878 173
Chas. P. Edison

Ore, bige Lode - good conductor

Ore, Pewafic Lode, good Condr

Paraffine non Conductor

Spermacetti Non Conductor

Chloride Lime went up to 7 degs and polarized

Fire Clay Non Conductor

Bi ox mang - 70 ohms

Indian Hemp non Conductor

Sugar - shows 2 degs

New Receiver Dec 19th 1878
Chas P Edison

Sulphate Zinc _ non Conductor

—

Ferrocyanide Pattassium N.C.

—

Bronze Non Conductor

—

Lunac Non Conductor

—

Russian Isinglass N.C.

—

Chalk _ non Conductor

—

Protosulphate Iron Non Con

—

Rosin . non Conductor

New Receiver Dec 19th 1878. 171
Chas. P. Edison

Sago — Non Conductor

Gambooge — non Conductor

Bichromate Potash N.C.

Gum Hemlock N.C.

Dog wood — N.C.

Ferro Cyan Potash NC

Argols Non Cond

New Receiver Dec 19th 1878
Chas P. Edison

Tripoli — non Conductor

Zinc. grain — good Cond

Cam wood — non Cond

Flax — non Conductor

Saffron — non Cond

Sesquichloride Iron 540 ohms
damp

Blue Flag show 1 deg with
pressure

181

New Receiver Dec 19th 1878
Chas P Edison

Catchen Nonconductor

Potassii Chloridum N.C.

Rutile Titanium Oxide N.C.

Logwood Non Cond'r

Sulphuret Iron perfect Cond'r

Quince Seed N.C.
White Snake root - N.C
Cinnamon Bark N.C

New Receiver Dec 19th 1878 180
Chas. P. Edison

white Bryony root NC
Rosemary Leaves NC
" Flowers NC

Blood root NC
Gum Myrrh NC
Hounds Tongue NC
Colts foot root NC
Cardamon Seeds NC
Orris root NC
Zodary NC
Pomegranate Peel NC
Geranium NC
Button snake NC
Plantain seed NC

New Receiver Dec 19th 1878 [?]

Chas R Edison

wild cherries	n c
Ipecac	n c
Pareva Brava	n c
Pumkin Seeds	n c
Peach Pits	n c
Anise Seed	n c
Savin.	n c
Muskmelon seed	n c
Borage Flowers	n c
German Valerian	n c
Mountain Heath	n c
Burdock Seed	n c
Buckthorn Berries	n c
Carroway Seed	n c
Indian turnip	n c

New Receiver Dec 19th 1878
Chas. P. Edison

golden seal	nc
sweet birch bark	nc
Black Mustard seed	nc
Scurvy grass	nc
Wild Hound tongue	nc
Squaw weed	nc
Yellow Pond Lilly root	nc
white ash Bark	nc
Mountain ash Bark	nc
Angelica tree Seed.	nc
Manna	nc
Chicory root	nc
Cascarilla Bark	nc
Tormentilla	nc
Colts foot root	nc
Angustura Bark	

New Receiver Dec 19th 1878/7
Chas. P. Edison

wood betony	n c
Pin Oak acorns	n c
yellow Jasamine root	n c
Simarubia bark	n c
gold thread	n c
Queens Alba	n c
Unicorn Root	n c
Comfrey root	n c
Eucolyptus	n c
poppy Caps	n c
fumitory	n c
Belladona root	n c
Pussy willow bark	n c
Chiretta Herb	n c
Lemon balm	n c
Peony root	n c

New Receiver Dec 9th 1878

Chas P Edison

Bene Violet #.	N C
Asplenium Felix	N C
Buck Bean root	N C
Hibiscus	N C
Alum root	N C
Wild Celadine	N C
Wild Carrot Herb	N C
Aconite Root	N C
Liverwoot	N. C.
Sassafras Pith	N C
fenugreek seed	N. C.
Yellow root	N C
apple tree bark	N C
Dewberry root	N C
Dogwood	N C

New Receiver Dec 19th 1878 193

Chas P Edison

Bitter Orange peel N C

Ginger root N C

Potentilas repens N C

Ergot N C

Mexican Sarsparilla N C

Blackberry root N C

Bitter Almonds N C.

Balm of [illegible] N C

Soap bark N C

Rose flowers (leaves) N C

Colombo N C

Lung Moss N C

Ginseng N.C.

Barbary Bark N C

New Receiver Dec 19th, 1878 193

Chas P Edison

Blue Cohosh NC

American Colombo NC

Low Centaury . . NC

Wafer ash Bark NC

+ Chloride Baryium N.C.

Ammonia Citrate Iron shows

5 dips - with pressure

Fusible Metal good conductor

Pebble stones - Non Condr

Fused Nitre " "

Stearic Acid " "

Arsenious Acid " "

Sesqui-oxide Iron " "

New Receiver Dec 19th 1878

Chas P. Edison

Phosphate Soda — Non Conductor

Iron ~~with~~ with Sulphur — good conductor

Bi-Tartrate Potash — non Cond

woodbridge Clay "

Iron Pyrites "

Sulphate Calcium "

Soap Stone "

Benzoic Acid "

Silicic acid "

Gum Senegal "

Black Flux 8000 ohms res —

Ferro Cyan Iron Non Conductor

Oxide Copper shows 3 degs

Acetate Soda " 2 "

New Jersey Dec 19th 1878
Chas. P. Edison

Iodide Lead Non Conductor
Anilinered shows 2 degs
Hickory Nut shell - Non Condr
Tar - non Conductor
Carb - Copper - Non Condr

---

paper soaked in Sat Sol Nit-
Potash - Non Conductor

Boric acid - non Condr
Litmus non conductor

Burnt umber Non Condr

Oxalate Ammonia N C
Arsenomic acid N C

New Receiver Dec 19th 1878
Chas. F. Edison

Carbonate Iron N.C.
Anthracine N.C.
Sulphate Mercury 440 ohms damp
Brass Filings, Conductor by Heavy pressure
Oxalate Iron Non Conductor
Bonian's phosphoras. Non Condr
Wach's phosphorus, Non Condr
Powd. Battery Carbons - perfect Condr
~~Carb Ammonia resistance~~
Horse Chesnuts - Non Condr
Pumice Stone Non Conductor
Gum Substitute N C
Amalagam good Conductor
Sulphate Antimony

New Receiver Dec 19th 1878
Chas P Edison

Antimonic acid NonConductor

Pepper - NonConductor

Amber - NonConductor

Spongy Platinum perfect Condr

Pulv. Aloes - N.C.

Borate Baryta N.C. -

Prussian Blue N.C

Ferro Cyan Copper N.C.

Gallic acid N.C.

Brimstone N.C.

Sulphate Potash N.C

Sulphide Calcium N.C.

Carb Potash - 140. ohms (wet)

Sand Plain

two men of
Sandy
Bar

New Receiver Decr 9th 1878 205

Chas P Edison

Powd Charcoal Non Conductor

Pyrolusit 40 ohms ores

~~Tartaric Acid~~ non Conductor

Purging Cassia non Conductor

Carbon made from gas perfect Conductor with pressure

Sumack Leaves non Conductor

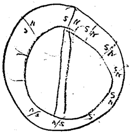
Acetate Mercury N.C.

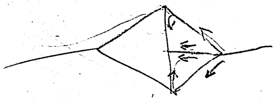
Fluoride of Calcium N.C.

Arsenious Acid N.C.

New Receiver Dec 19th 1878

Thos A Edison





Thos. A. Edison

Chewing Tobacco - 3700 ohms res

Cyanide Potash 9000 ohms

Sudbear - Non Conductor

Bromide Potass non Conductor

Nitrate Ammonia - shows 3 degs -

Flower Sulphur - Non Conductor

Butter Nut Bark - Non Conductor

Chloral Hydrate - shows 2 degs

Tumeric - Non Conductor

Chlorate Potash - Non Conductor

New Receiver Dec 22nd 1878

Chas P Edison

Coddys Lampblack - perfect Conductor

Methylviolet - Non Conductor

Permanganate Potash - 2000 ohms

Powd Charcoal - shows 1 deg

Baric Chloride Non Cond

garden Celamine Non Cond

Nut galls non Conductor

Powd Marble N.C.

Walnut shell N.C.

Oxalic acid show 3 degs

New Receiver Dec 22nd 1878
Chas. P. Edison

Rosin Weed non Conductor

Pennyroyal N.C.

Male Fern Root N.C.

Dragons Blood N.C.

Buckeye N.C.

Sumac N.C.

Shoe Makers Wax - cant get d—
stuff out of bottle

Tellurium Ore - N.C.

Sulphuret Soda - N.C.

New Receiver Dec 22nd 1878
Chas. P. Edison

Carb Magnesia N.C.

Iodine Resublimed N.C.

Nitrate Strontia N.C.

Drop Black ~~100~~ 100 ohms

Red silk cut 1/2 doz times over
with plumbago - good -

Lamp Black made from gasoline
Combustion furnace - perfect Condr

Scarlet Aniline - Non Conductor

Black Aniline (water)

Gold beaters Skin

New Receiver Dec 22nd 1878

Chas P Edison

Black Aniline (Alcohol) N.C.

Jobs Tears N.C.

Elecompane seed N.C.

Silk boiled in Chloride Zinc 100 ohms

HAIR From a BAT with Carbon, good Conductor

Balsam apple seed N.C.

Pulv Scamony N.C.

New Receiver Dec 22nd 1878
Chas. P. Edison

Birds foot Violet - N.C.

Cape aloes N.C.

Balsam Apple Fruit N.C.

Blk Hellebore Root. N.C.

New Receiver Dec 24th 1878
Chas. P. Edison

Experiments with paper soaked with differant oils. for conductivity with No 1 coil & 6 cells Callaud battery

Oil Cloves — nonconductor
" white thyme "
" Fennel "
" Crotin "
" Fusel "
" Wintergreen "
" Spearmint "
" Anise "
" Juniper wood "

New Receiver Dec 24th 1878

Chas P Edison

Juniper Berries	non	Condr
Pennyroyal	"	"
Orange	"	"
Bergamot	"	"
Lemon	"	"
Succini	"	"
Wormseed	"	"
Citronella	"	"
Rosemary	"	"
Tansy	"	"
Carui	"	"
Cade	"	"
peppermint	"	"
Lemongrass	"	"
Lavender Flower	"	"

New Receiver Dec 26th 1878 —

Chas Edison

~~Sulphuret of Tin~~

The following Chemicals &c are good Conductors and good for base of button.

Sulphuret Tin

Prussiate of Tin

Cadmium Oxyde

Chromic Acid [illegible]

Sulphuret Copper

Sesquechlorid Chrome

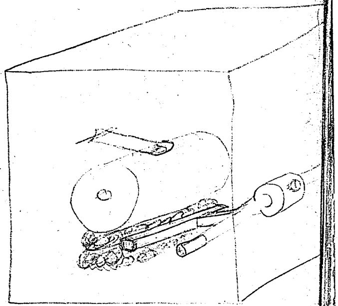
Chlorat [illegible]

Nov/Receiver Dec 26th 1878
Chas P. Edison

Nickel Carbonic –
protoxide Iron
Uran Nitric
Uran Kalium Acetic
Iron by Hydrogen
Uran Sulfuricat –
Cerium Sulfuric
Iodide Baryum
Chlorate Strontia
Tartrate Potash
Cobalt Oxydat
Sodium Permanganate

New Lowen [?] Decr 6th 1878

Chas P. Edison



Now is the winter of our discontent

Charles

New Year

Now is the

the win

now is the winter of our

Now

Now is the winter

Happy New Y

A happy New Year

Merry Christmas

Mid:

Midnight Midnight

Midn Mid Middle of the night

Midnight

Midnight

Dear Sir Received

Yours R

New Receiver

New Receiver

Johnson

Happy New Year

NEW RECEIVER

Dec 28th 1875

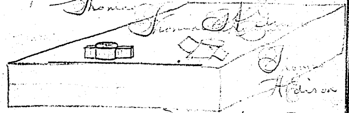
New

New Receiver

New Year

Thomas

Thomas A Edison



Thomas

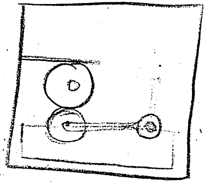
Edison

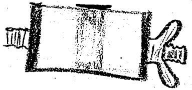
N

NEW RECEIVER Dec 2[illegible] 187[illegible]

204

Chas P E





New Receiver Jan 7th 1879

Chas. P. Edison

\#

Bases for Buttons using Caustic Soda and Acetate mercury for each

\#

Black oxide Manganese has no Motograph Effect does not mould good and when wet is to soft

\#

Carbonate Barytes has good E.M.G. Effect and moulds good

\#

Lithage has very little Emg Effect dont mould good

205

New Receiver Jan 7th 1879
Chas. P. Edison

Tripoli - has fair emf effect ~~[illegible]~~
~~[illegible]~~
~~[illegible]~~
~~but~~ the friction does not appear [illegible] seconds after the current has been [illegible]

damar - work quite opposite to [illegible] more friction when the [illegible] is on

Tripoli is to soft after being wet it all scales off
N.G. NO GOOD N.G.

New Receiver Jan 8th 1879
Chas. P. Edison

Button turned from piece of Charcoal Soaked in Solution Caustic Soda, dried out, and then soaked in Solution of acetate mercury is no good has no Motograph Effect whatever has bad ohm resistance

Chlor Potass has fair Emf Effect but does not mould good, crumbles,

Caustic Magnesia has good Emf Effect Moulds good

New Receiver. Jan 9th 1879 241

Chas. P. Edison

Cantons Phosphorus has pretty good Emg Effect - but dont mould as good as chalk

Nut galls has a Little Emg effect - but is N.G. by putting water on. Makes a paste on surface

Brimstone - has very slight Emg Effect - is too soft when water is put on

Sulphat Antimony has Very small Emg effect Moulds good

New Receiver Jan 9th 1879

Chas [illegible]

Burnt Umber has pretty good Eng Effect also makes good

Sugar is Ng. for Eng Effect

Ferrous Chloride with Chalk and Acetate of Mercury has no Eng Effect

---

Anthracine with Acetate Mercury has no Eng Effect

New Receiver Jan 9th 1879
Chas P Edison

Borate Baryta has
good Emg Effect and
moulds good

Bromide Potassium has
very small Emg Effect

Sulphide Potassium has
pretty good Emg Effect
but is too soft and
crumbles

New Receiver Jan 9th 1879

Chas. P. Edison

Veneer of Vulcanized fibre first soaked in solution of Acetate Mercury and then in solution of Caustic Soda has not the least Electro Motograph effect is N.G.

Bi Carb Soda has only [illegible] Eng Effect N.G.

Alum has fair Eng. Effect Moderately good

New Receiver Jan 9th 1879
Chas. P. Edison

Whitening - has good Emg Effect as good as chalk if not better moulds good will make large one for Recr

Borax fair Emg Effect moulds good

Alum has nothing Effect

C. P. E.

B Barium Iodide

C Cadmium oxalate 90
Chromic acid wet 140
Copper sulphate 90
Chrome, sesquichloride 140
Cyprium chloride 900
Cerium Sulphate
Cobalt oxide

D

E

F

G

H

I Iron peroxide
" by hydrogen

J

K

L

M

N Nickel carbonate

179

Potash chlorate

Q

R

S ~~Sulphuret Tin~~
Ammonia Chlorate
Sodium permanganate
Sulphate Silver

T Tin Sulphuret of
Protochloride Tin of

U Uran nitrate
" Kalium " [illegible]
" Sulfur wet

V

W

X

Y

3

Sat. 7
Sun 8
Mon 12
Tues 10
Wed 14

[illegible]mbols 223

Na_2SO_4 — Sulp Soda.

$CaCO_3$ Chalk

Hg-ā Ac mer

Ca_2PO_4 Phosphate Lime

Na_2O Caustic Soda

$MgSO_4$ Sul Magnesia

137 Anthrachinon
138
141 Sulp. Mer
145 Powd Drawing Carbon
146 Pumice Stone
147
152 Sulph Antimony
157
153 Pepper
154
155 Borate Baryta
159 Prussian Blue
160
163 Brim Stone
163 Sulphate [illegible]
165
168 Sulphur [illegible]
169
171 Charcoal

Animal Charcoal
Aspirin [illegible]
Borax
Alum
Sal Ammoniac
Rotten Stone
Fire Clay
Bi Carb Soda
Chlor [illegible]
Bermuda [illegible]
Salt Petre
Bi Chrom Potash
Potassium [illegible]
Chemical [illegible]
Phosphate [illegible]
Sulphate [illegible]
Tar
[illegible]

Menlo Park Notebook #6 [N-78-12-04.1]

This notebook covers the period December 1878-January 1879. Most of the entries are by Francis Upton. There are also entries by Edison, Charles Batchelor, and John Kruesi. All of the material relates to experiments on electric lighting. There are many calculations by Upton about generators and system costs, including comparisons to gas lighting costs; drawings and tests of lamps; notes on silicon and graphite; and notes and drawings of generators. The book contains 284 numbered pages.

Blank pages not filmed: 214-249, 254-257, 266-273, 280, 283.

Missing page numbers: 275-278, 281-282.

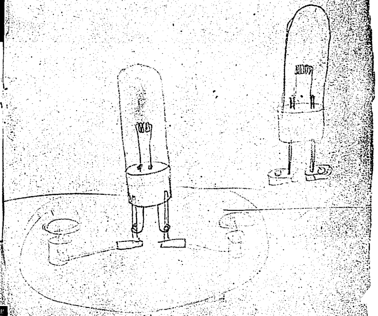
No. 6

[illegible] N.Y.C.

May [illegible], 189[illegible].

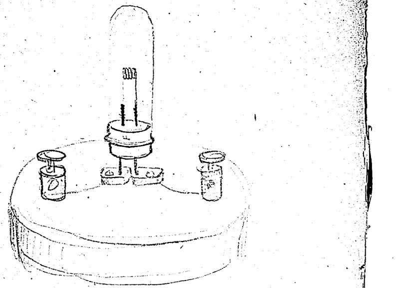
Electric Light   Dec [illegible]

J. Kruesi



Electric Light Dec 4 10 1878 3

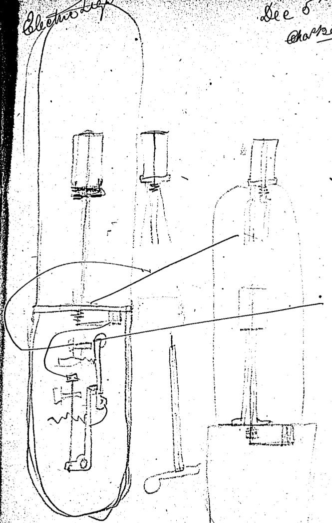
J Kruesi



Electric Light

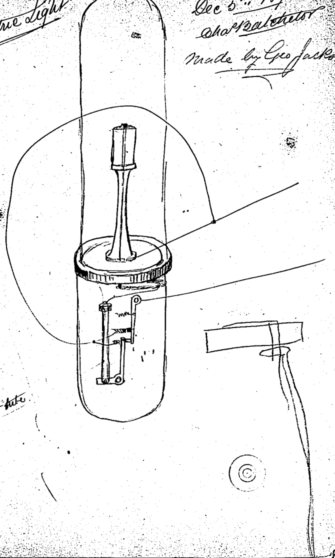
Dec 5th 1878

Chas Batchelor



Electric Light

Dec 5th 1878
Chas Batchelor
made by Geo Jackson



Line tute

$1 = \varepsilon \frac{1}{1}$

$\cancel{R} = \frac{12}{3}$

Heat $= C^2$

$C = 1$
$R = 1$
Heat $= 1$

$C = 2$
$R = 1$
Heat $= 4$

$$C = \frac{\mathcal{E}}{R}$$

Heat $= C^2 R$

1 H.P. $\mathcal{E} = 1$
$R = 1$

$C = \frac{1}{1} = 1$

Heat or work $= 1$

~~2 H.P.~~ $\mathcal{E} = 2$
$R = 1$

$C = \frac{2}{1} = 2$

~~Heat or work~~
or H.P. $= 2^2 \times 1 = 4$

12 Wallace
100 revolutions

$R = 10$ Ohms Outside
$r = 10$ inside
1 Horse power to rotate machine independent of the current
2 Horse power in
Electro motive force $= 1$
Outside work 6 lamps

Double the speed
H.P. No Lamps?

24 inches Batch 13
19 inches Edison
$7\frac{1}{4}$ 22 " Mark

1 H.P. for Elec.

$\neq C = \frac{20}{10+10} = \frac{1}{2}$

2 H.P. in all Work = ~~1~~ ~~½ Work perH.~~

2 H.P. for friction
4 Hp for Elec

6 H.P.

$\frac{2}{3}$ work per HP

6 Hp Work 4

$\frac{2}{3}$ $\frac{4}{3}$ $1\frac{1}{3}$

~~4~~ Hp for friction
16 Hp " Elec
20 Hp in all

$\frac{16}{20}$ $\frac{4}{5}$ work per H.p.

No 1 100 HP Work = $\frac{1}{2}$
2 200 revolutions " " = $\frac{2}{3}$
3 400 revolutions " " = $\frac{4}{5}$
4 800 revolutions " " = $\frac{8}{9}$

8 Hp
64
72

$\frac{64}{72}$ $\frac{8}{9}$

$\frac{3}{2}$

16

1000 revolutions

Friction 1 H.P.

Elec 1 H.P.

External $R = 10$

Internal $r = 10$

1 lamp outside for two Horse Power

10 inches with one unit of work on the ten inches.

$$C = \frac{20}{10+10} = 1$$

$$\cancel{Heat} = C^2R = \cancel{1}0$$

$$Heat = C^2R = 20$$

17

2000 revolutions

Friction 2 H.P.

Elec ~~4 H.P.~~ ?

External 30

Internal 10

$$C = \frac{40}{30+10} = \frac{40}{40} = 1$$

$$Heat = C^2R = 30$$

~~3 lamps for 5 H.P.~~

No. 1. $\frac{1}{2}$ lamp for 1 H.P.

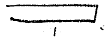
$\frac{3}{5}$ lamps " " "

4 000 Revolutions

4 ~~H.P.~~ for ~~Traction~~

T H.P. for Elec.

10 inside



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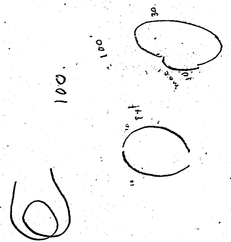
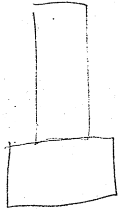


 1000 revolutions

2 Horse power put on a Gramme machine will give 1000 revolution the total resistance being 20 Ohms, 10 in & 10 out.

If the Horse Power is doubled i.e. - 4. H. P and the total resistance is doubled i.e. 30 out 10 in = 40, the speed of the machine will increase to 3.000 revolutions and doubles



a Gramme machine
Gives 85° in work

the work will be ob-
tained,

2 H.P.

Perfect Gramme

~~1~~ H. P 1000

10 inside 20=E
10 outside

C = 1 Total Work = 20
Useful " = 10
Useless " = 10

1 HP 2000
5 inside
15 outside

Total = 20.
Useful = 15
Useless = 5.

4000 revs

2 1/2 inside

17 1/2

17!

20 total
17 1/2 useful
2 1/2 useless

1 1/4 8000

×

×

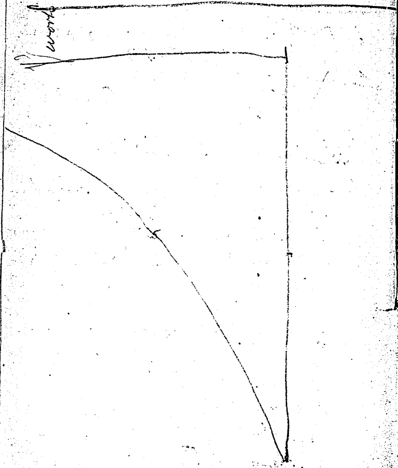
3/4 16000

3/8 32000

Perfect Gramme

If the speed is doubled the electromotive force is doubled. If the internal resistance is halfed the E-F. is halfed, at the same time ~~and~~ external increased half; Total the same. If both at same time Elec. Force remains constant

26 Gramme 85 % Elec
15 % Friction



27

50 % friction
50 % Electricity Gramme

1 H.P. Friction
1 H.P Electricity

1000 revs = 2 H.P

10 out = R
10 in = r
C = 1

Work = 20 Units
useful = 10
useless = 10
5 useful per H.P

15 out
5 in
2000 revolu.

~~2~~ H. P friction
1 H. P Elec
= 3 H. P

Work 20
useful 15
useless 15
5 useful per H. P.

72 Friction
28 Current } Wallace

---

1. H. P Current

3 H. P Friction

1000. revs.

10 in
10 out

20 work
10. useful
10 useless

Useful per horse power $2\frac{1}{2}$ per. H. P

2000. revolutions

5 in
15 out

20 work
15 useful
5 useless

---

6 Hp Friction
1 H. P.

7

$\frac{15}{7} = 2\frac{1}{7}$

~~80°~~ ~~45°~~ for Gramme

45 Friction
55 Current

$\frac{1}{4}$ Current
$\frac{3}{4}$ Friction

= 1 HP

$1\frac{1}{x}$

4 HP

Siemens 15 Friction
85 Current

$\frac{3}{13}$ Hp Friction
1 Hp Current

revol
10 in
10 out

work 20
useful 10
useless 10

$\frac{10}{1\frac{3}{13}}$

8.1 Useful per H.P

~~revolution~~
5 in
15 out

$\frac{6}{13}$ Friction
1 Current

20 Work
15 useful
5 useless

$1\frac{6}{13}$ Total H.P

10.2 Useful

$\frac{3}{13}$

13) 3.0 (.23
26
40
39

1.92

1.23) 10.00 (8.1
984
160

1.92) 17.5

1.46) 15.0 (10.2
146
400

4X
$2\frac{1}{2}$ 2.5
$17\frac{1}{2}$ 17.5

4000 revolutions

$\frac{12}{13}$ Friction
1 Current

$17\frac{1}{2}$ useful
$2\frac{1}{2}$ useless

$1\frac{12}{13}$

32

33

$\frac{1}{2}$ Friction = 1

$\frac{1}{2}$ Current

¼ " "

1 Friction 4

2 ~~3~~ Current 3

4 do

3 Work 4

$\frac{1}{2}$ Work 1

2 $\frac{1}{2}$

$\frac{3}{4}$

34 2 on

$\frac{1}{2}$ H.P. Friction

$\frac{1}{2}$ H.P. Current

---

4 amo

1 H.P. Friction

2 H.P. Curr

3

13)100(.8

April 1 38

(4) Friction 1 H.P. 20

Current 1 H.P. 10

---

(5) H.P. 6 H.P.

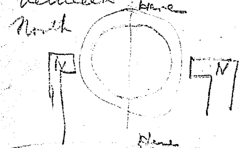
Friction 2 H.P. 8.0

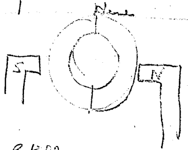
4 H.P. .6

4 times Current 3 13.

36

Rotating soft iron
ring soft as magnetism
as when still when
between the two poles as





Still none
Rotating same
Perhaps the covering of brass
carried the currents around the
Not so the same with out a helix.

Wallace 37

3 Hp Friction
4/5 1 HP Current 20
4
6 HP
8 80
4/10

8. 14 Hp 3.5) 4200 (1200
3500
700

Siemens

Hp. 8) 14000 (1
8000
6000

Hp. 2) 1200
600

1750

600
1200
1750

Electro Magnet

Wire 0,0033 Metre
Weight of ca. 24. Kilo

Coil
Weight of wire wound
14 Kilo

Diameter of wire 0,0026 Metre

Magnet 0.0038 Metres

Weight 14,30 Kilo

Coil Diameter 0.002
Weight 4.25

.02

.09

48

The combustion of a cu. ft of common gas will heat 65 Gallons of H_2O 10

Harwell.

65 Gallons   1 Gal = 8.32 Lbs

8.32
65
4160
4992
54.08 Lbs

5 cu. ft. a hour for one burner

270 400
772   Ft. lbs. for 1° Fahr.

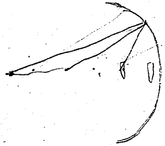
2704
772
5408
18928
18928
2,087,488 ft. lbs.

2.087.488

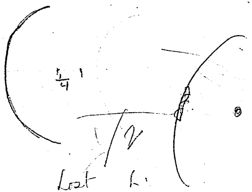
33.000
60
1,980,000) 2,087.488 (1.07
1980000
1.0704880

5 cu. ft per hour

1 Gas burner would drive if all its heat could be used a one horse power engine with a little to spare



Mirror 1 in radius.



Lost L.

96. 4 90.

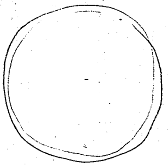
1/2

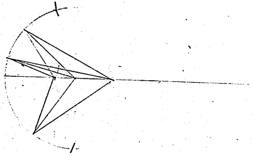
1/8

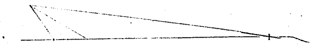
Portland

8

92







6 ft $8\frac{1}{2}$ in

4 wires No. 36

6 ft $8\frac{1}{2}$

4

30 90. 6.66

.7

$$6.7\,)\,90.0\,(\,13.$$

67
230
201
90

6 [illegible] 2 ff ?

15

~~[illegible]~~ Lamp

Gramme Machine

1 Ohm

One inch incandescent Pt will give light equal to one gas burner. Therefore to have six lights per horse power, a machine using one horse power must heat a wire of ~~[illegible]~~ with five inches of surface white hot.

Iron wire 0.017 in diam.

7 feet

~~.017~~

12	3.14
7	.017
84	2198
.053	314
252	.05338
420	7
4.452	

3.14
.017
2198
314
.05338
84
212
424
4.452

2 candle 10 cells

260 260

26

$15 \overline{)52}$ 3

2 candle

Four iron wires .017 in in diametre were heated to a dull red by the Gramme machine. Their resistance was estimated at $\frac{1}{2}$ Ohm and their surface at 15 inches ✓

400 lbs for 24 hours
heating building

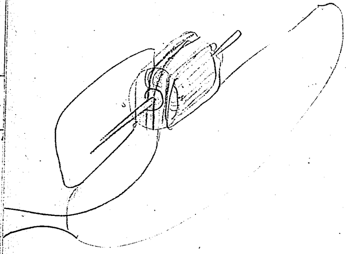
~~1200~~
1200 lbs for the engine
working 12 hours
giving about 10 horse power

10 lbs per hour

$4.30 for 2200

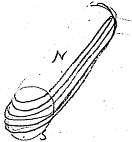
2200) 4,30.00 (.002 1/5 ct
4400

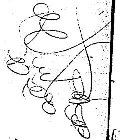
1/5 ct per lb



6.54
.8
54.0

6.





34
12
108
54
648

.017

3.14
.017
2198
314
.05338
648
4264
2132
3198
34.5384

136.

50

54

24

55

99·1 : 1

6/1·100
·183

46+6" of 33 copper wire

46/99·+

99 : 1 9.9/46·00/·5

99·1 : 1 :: 46·5 : ·4 7/8

9.9/46·5·0/·47
39 6
·6 8 6
6 9 3
47
16

54

Jan. 13. 1879

Jabhalkoff.

$2\frac{1}{2}$ h.p. 50.
Carbon 100
150.

Light unopposed 3500 candles
modified 1750 cands.
in - 5 places,

E

15 h.p.
Cost 150, -

Total light. 13.50.

Distribution 90. at 15

15
90
1350

1350
450
E 1800,
Jabk. 1750.

$2\frac{1}{2}$ Jablochkoff costs $2\frac{1}{2}$ H.P.

say 25 cts. for power
50 cts " Carbon
75 cts.

will pay for $7\frac{1}{2}$ H.P.

$7\frac{1}{2}$

Jan. 13 6 lights per horse power
45
2 Glass Globes round the Jablochkoff
90 Lamps

15
6
90.

90
15
1350 candles

$2\frac{1}{2}$ Jab =
= 2500

But 1350 candles can be distributed add $\frac{1}{3}$ 1700 or more

Labor not counted

Jan 13

,24

$$\begin{array}{r} 3.14 \\ .33 \\ \hline 2 \end{array}$$

$$\begin{array}{r} 3.14 \\ .24 \\ \hline 1256 \\ 628 \\ \hline .6536 \end{array}$$

$$16\overline{)5.0}(31$$
$$\begin{array}{r} 48 \\ \hline 20 \end{array}$$

$$\begin{array}{r} 3.14 \\ .31 \\ \hline 314 \\ 942 \\ \hline .9734 \end{array}$$

1.00

~~24 inches~~

Gas costs say 1.00 per 1000 ft
1 ct per 10 ft

~~1.5 cts per 15 ft~~ or ~~[illegible]~~
.5 ct per 5 ft

H.P. cost $\frac{4}{5}$ ct per hour
say 1 ct per hour

2 lamps per horse power would pay

Jan 16

$\frac{13}{4}$ row 4 each

when red hot 5 X 4 = 20 ohms in each

$\frac{20}{13}$ = 1,54 = Resistance in all

$$\begin{array}{r} 13\overline{)20}(1.54 \\ \underline{13} \\ 70 \\ \underline{65} \\ 50 \end{array}$$

Belt for two horse power

8)56 Lamps heated
7 8 times as much for incandescence

$3\frac{1}{2}$ per horse power

Jan. 15 1.300 6000 ft

~~348~~ 34 mm

Yellow bright

620 mm heated

~~Bright~~ Grampus red when 13 mm
given spiral wire in multiple area
with 9.8

9.8
4.1
96
342
40.18

150) 620 (4.1
600
200

499
4.1
500
205 0.0

2050 energy
given off on 620 mm wire

620 mm
4
24.80

.004
3.14
.004
.01246

248
.0124
992
496
248
.30752

Yellow

150) 380 (2.5
200
80

11.
2.5
55
22
270

White 18.5
150) 220 (1.46 146
150
700
600
1000
900

Duncan

150) 193 (1.2 1.2
150 1720
430 1.2
300 3440
130 1720
20640

Melts 172 mm

6.39 639
1.2 4.1
1278 639
639 2529
7.668 25.930
Cold

Piece wire - pt. 440 mm long - wire flattened into a ribbon - weight after cleaning by momentary incandescence, 0.3430 grammes. We now fix it in Gramme machine for 3 hours —

Jan 30 1879

Silicium or Silicon =

Watts p. 267 Vol V
Obtained in free state by action of reducing agents on the chloride ~~and~~ or fluoride and assumes the 'amorphous' 'graphitoidal' or crystalline state according to the mode of separation.

Amorphous Si is brown powder, non conducting fuses at melting point of steel in a non oxidising atmosphere.

Graphitoidal;—
May be heated to whiteness in O. without undergoing any alteration in weight. I wonder whether this is a conductor.
Made by fusing 1 pt Aluminium 5 pts glass free from lead 10 pts powd. Cryolite together, treat the mass with HCl, then with Hydrofluoric Acid

Graphite Silicium   Try this

Fuse in Hessian crucible

5 parts Soluble glass (Potassium Silicate)
10 parts Cryolite (Sodium + Al fluoride)
1 part Aluminium

Treat the button with HCl. Si remains in shape of scaly crystals like graphite. It is infusible   Fowne 210

.0143 To be multiplied by the square root of the numerals

.000162 To be multiplied by the numerals

.001208 To be multiplied by the square of the numerals

Divide the last product by four. (4)

74

4) .125
.31 1/4

75

(2)

.0143
1.41

0143
0572
0143

.020163

.000162
2

.000324

~~.0125~~
~~4~~

.0500

4) .0500
.0125

~~.001208~~
~~4~~
~~.004832~~

~~4) .004832~~
~~.001208~~

(3)

.0143
1.73

0429
1001
0143

.024739.

.000162
3

.000486

~~1.001208~~
~~9~~
.010872

~~4) .010872~~
~~.002718~~

.0125
9

4) .01125
.00281 1/4

76

(4)

$$\begin{array}{r} .0143 \\ 2 \\ \hline .0286 \end{array} \qquad \begin{array}{r} .000162 \\ 4 \\ \hline .000648 \end{array} \qquad \begin{array}{r} .0125 \\ 16 \\ \hline 0750 \\ 0125 \\ \hline .02000 \end{array}$$

$$\cancel{\begin{array}{r} .001208 \\ 16 \\ \hline 007248 \\ 001208 \\ \hline 0.019328 \end{array}} \qquad 4\overline{).02000} \; .00500 \qquad \cancel{4\overline{)0.019332}} \; \cancel{0.004833}$$

(5)

$$\begin{array}{r} .0143 \\ 223 \\ \hline 0429 \\ 0286 \\ 0286 \\ \hline .031889 \end{array} \qquad \begin{array}{r} .000162 \\ 5 \\ \hline .000810 \end{array} \qquad \begin{array}{r} .0125 \\ 25 \\ \hline .0625 \\ 0250 \\ \hline 0.3125 \end{array}$$

$$\cancel{\begin{array}{r} .001208 \\ 25 \\ \hline 006040 \\ 002416 \\ \hline 0.030200 \end{array}} \qquad \cancel{4\overline{)0.030200}} \; \cancel{0.007550} \qquad 4\overline{)0.3125} \; 0.0781\tfrac{1}{4}$$

(6) 77

$$\begin{array}{r} .0143 \\ 244 \\ \hline 0572 \\ 0572 \\ 0286 \\ \hline .034892 \end{array} \qquad \begin{array}{r} .000162 \\ 6 \\ \hline .000972 \end{array}$$

$$\begin{array}{r} .0125 \\ 36 \\ \hline .0750 \\ 0375 \\ \hline 0.4500 \end{array} \qquad 4\overline{)0.4500} \; 0.1125$$

(7)

$$\begin{array}{r} .0143 \\ 264 \\ \hline 0572 \\ 0858 \\ 0286 \\ \hline .037752 \end{array} \qquad \begin{array}{r} .000162 \\ 7 \\ \hline .001134 \end{array} \qquad \begin{array}{r} .0125 \\ 49 \\ \hline .1125 \\ 0500 \\ \hline 0.6125 \end{array}$$

$$4\overline{)0.6125} \; 0.1531\tfrac{1}{4}$$

(8)

.0143
2.82
0286
01144
0286
.040326

.000162
8
.001296

.0125
64
0500
0750
0.8000

4) 0.8000
0.2000

(9)

.0143
3
.0429

.000162
9
.001458

.0125
81
0125
1000
1.0125

4) 1.0125
0.2531 1/4

(10)

.0143
3.16
0858
0143
0429
.045188

.000162
10
0.001620

.0125
100
01.2500

4| 1.2500
0.3125

(11)

.0143
3.31
0143
0429
0429
.047333

.000162
1.1
000162
000162
0.0001782

.0125
121
0125
0250
0125
1.5125

4) 1.5125
0.3781 1/4

(12)

.0143
3.46
0858
0572
0429
.049478

.000162
12
000324
000162
0.001944

.0125
144
0500
0500
0125
01.8000

4) 0.18000
0.04500

X

(13)

.0143
3.60
085800
0429
.051480

.000162
13
000486
000162
0.002106

.0125
169
1125
750
125
2.1125

4) 2.1125
$0.5281\frac{1}{4}$

(14)

.0143
3.74
0572
1001
0429
.053482

.000162
14
000648
000162
0.002268

.0125
196
0750
1125
0125
02.4500

4) 02.4500
00.6125

X

15

.0143
3.87
1001
1144
0429
.055341

.000162
15
000810
000162
0.002430

.0125
225
0625
0250
0250
02.8125

4) 02.8125
$00.7281\frac{1}{4}$

(16)

.0143
4
.0572

.000162
16
000972
000162
0.002592

.0125
256
0750
0625
0250
03.20000

4) 03.200
00.800

(17)

.0143
4.12
0286
0143
0572
.058916

.000162
17
001134
000162
0.002754

.0125
289
1125
1000
0250
03.6125

4) 03.6125
00.9031$\frac{1}{4}$

(18)

.0143
4.24
0572
0286
0572
.060632

.000162
18
001296
000162
0.002916

.0125
324
0500
0250
0375
04.0500

4) 04.0500
01.0125

(19)

.0143
4.35
0715
0429
0572
062205

.000162
19
001458
000162
0.003078

.0125
361
0125
0750
0375
04.5125

4) 04.5125
01.1281$\frac{1}{4}$

(20)

.0143
4.47
1001
0572
0572
.063921

.000162
20.
0.003240

.0125
400
05.0000

4)05.0000
01.25000

(21)

.0143
4.58
1144
0715
0572
.065494

.000162
21
.000162
000324
0.003402

.0125
441.
.0125
0500
0500
05.5125

4)05.5125
01.3781 1/4

(22)

.0143
4.69
1287
858
0572
.067067

.000162
22
000324
000324
0.003564

.0125
484
.0500
1000
0500
06.0500

4)06.0500
01.5125

(23)

.0143
4.79
1287
1001
0572
.068497

.000162
23
000486
000324
0.003726

.0125
529
1125
0250
0625
06.6125

4)06.6125
01.6531 1/4

(24)

.0143
4.89
1287
1144
0572
.069927

.000162
24
000648
000324
0.003888

.0125
576
0750
0875
625
7.2000

4)7.2000
1.8000

(25)

.0143
5
.0715

.000162
25
000810
000324
0.0040500

.0125
625
0625
0250
0750
07.8125

4)7.8125
1.9531$\frac{1}{4}$

(26)

~~.0143~~
~~5.10~~
~~1287~~
~~0715~~
~~.072787~~

.0143
5.10
.01430
0715
.072930

.000162
26
000972
000324
0.004212

.0125
676
0750
0875
0750
08.4500

4)08.4500
02.1125

(27)

.0143
5.20
02860
0715
.074360

.000162
27
001134
000324
0.004374

.0125
729
1125
0250
0875
09.1125

4)09.1125
02278$\frac{1}{4}$

(28)

.0143
5.30
04290
0715
.075790

.000162
28
001296
00324
0.004536

.0125
784
500
1000
0575
09.8000

4) 09.8000
02.4500

(29)

.0143
5.40
05720
0715
.077220

.000162
29
001458
000324
0.004698

.0125
841
0125
0500
1000
10.5125

4) 10.5125
2.628 1/4

(30)

.0143
5.47
1001
0572
0715
.078221

.000162
30
0.004860

.0725
900
11.2500

4) 11.2500
2.8125

(31)

.0143
556
0858
0715
0715
079508

.000162
31
000162
000486
0.005022

.0125
961
0125
0750
1125
12.0125

4) 12.0125
3.0031 1/4

(32)

.0143
5.65

0715
0858
0715

.080795

.000162
32

000324
000486

000 5184

.0125
1024

0500
0250
0125

012.8000

4) 012.8000
03.2000

(33)

.0143
5.14

0572
1001
0715

.082082

.000162
33

000486
000486

000 5346

.0125
1089

1125
1000
0125

013.6125

4) 013.6125
003.4031$\frac{1}{4}$

(34)

.0143
5.83

0429
1144
0715

.083369

.000162
34

000648
000486

0.005508

.0125
1156

0750
0625
0125
0125

014.4500

4) 014.4500
003.6125

(35)

.0143
5.91

0143
1287
0715

.084513

.000162
35

000810
000486

0005670

.0125
1225

00125
00250
00250
0125

015.3125

4) 015.3125
003.8281$\frac{1}{4}$

(36)

```
 .0143        .000162
     6             36
 .0858        000972
             000486
             0005832

 .0725
  1296
   [illegible]       4)016.2000
  [illegible]          004.0500
 0250
 0125
 016.2000
```

(37)

```
 .0143        .000162
   60              37
 014 3.0      001134
 0858         000486
 087230       0005994

 .0125
  1369
  1125
 0750        4)017.1125
 0375          004.2781 1/4
 0125
 017.1125
```

(38)

```
 .0143         .000162
  6.16              38
  0858         001296
  0143         000486
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 .088088

 .0125
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  500           004.5125
  500
  0125
 018.0500
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(39)

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 .0572         001458
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 0858          0006318
 .089232

 .0125
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  0125
 0250         4)019.0125
 0625           004.7531 1/4
 0125
 019.0125
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(40)

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075000 05.000
0125
020.0000

(41)

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.091520

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(42)

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53

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(59)

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104

(60)

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61. .1121 ~~.1123~~ — 0.892665 / 1.050265 / 1.049819

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4|46.51 / 1162 — 3.570660 / 1.667560 / 1.667570

105

(62)

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.01004 ~~.0100062~~ — 1.792392 / 2.002692 / 2.001907

4|48.05 / 12.01 — 3.584784 / 1.681684 / 1.681694

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.01020 ~~.01020~~ — 1.799341 / 2.009641 / 2.008856

4|49.61 / 12.40 — 3.598682 / 1.695582 / 1.695592

106
(64)

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1.060244

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2.015695

4 | 57.2004 3.612360
12.80 1.709260
1.709270

(65)

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1.063610

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2.022428

4 | 52.810 3.625826
13.20 1.722726
1.722736

(66)

19

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1.066926

.1069 ~~.010711~~ 1.819544
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2.029059

4 | 54.46 ~~54.449~~ 3.639088
13.61 1.735988
1.735998

67

.1175 ~~.11766~~ 0.913037
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1.070191

~~.01087~~ .01085 ~~.010864~~ 1.826075
2.036375
2.035590

4 | 56.114 3.652150
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1.749060

(68)

~~.11854~~ .1184 — 0.916254 / 1.073408

.01103 — 1.832509 / 2.042809 / 2.042024

4 | 57.80 / 14.45 — ~~57.799~~ — 3.635018 / 1.761918 / 1.761928

(69)

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ok

4 | 59.51 / 14.87 — 3.677698 / 1.774598 / 1.774608

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.01134 ~~.001136~~ — 1.845098 / 2.055398 / 2.054613

4 | 61.25 / 15.31 — ~~61.249~~ — 3.690196 / 1.787096 / 1.787106

(71)

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4 | 63.0 / 15.75 — 3.702516 / 1.799416 / 1.799426

(72)

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16.20 1.811564
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(73)

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4/66.66 3.726646
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1.823556

(74)

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1.091770

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4/68.45 ~~68.448~~ 3.738464
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1.835374

(75)

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~~70.31~~ 3.750122
4/70.31 1.847022
17.57 1.847032

112

(76)

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3 3 3 3 3 3 -3 3 3 $\bar{1}$.098007

$\bar{1}$.097561

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.01231 2.091114

$\bar{2}$.090329

4 | 72.20 ~~72.55~~ 3.761628

18 05 1.858528

(77) 1.858538

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$\bar{1}$.100399

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1852 1.869892

110

(78)

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3 $\bar{1}$.103647

$\bar{1}$.103201

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$\bar{2}$.101610

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19.01 1.881090

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.1276

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$\bar{1}$.105967

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4 | 78.01 1.892154

1950 1.892164

114

(80)

~~.1288~~ ~~.12834~~ 0.951545
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$\bar{2}$.112605

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20.00 1.903090

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$\bar{1}$.111396

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$\bar{2}$.123329

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116

(84)

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117

(86)

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2.005396

(91)

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$\bar{1}$.136674

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2.043166

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2.079362

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1.154971

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2.205150

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2.088180
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30.62

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$\bar{1}.157154$

.01620 $\frac{2.000000}{\bar{2}.210300}$

$\bar{2}.209515$

4/1250

3125

4 $\frac{.000000}{2.096900}$

2.096910

100

8.1421.

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2.008600

(103)

2.012837

124
(104)

2.017033

(105)

2.021189

(106)

128

2.025306

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(108)

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2.037426

(110)

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(111)

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136

(112)

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(113)

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(114)

137

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2.060698

132

(116)

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2.068186

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133

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(120)

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(122)

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132

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2.136721

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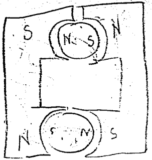

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2.247973

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179

2.252853

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181

2. 257679

182 1.079 $\bar{0}$.0330

1.125 0.0511

$\bar{1}$.9819

2

$\bar{1}$.9638

92

9

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2. 262451

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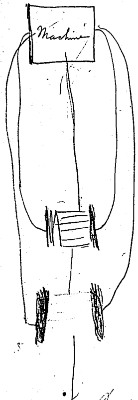


4 to one

4 to one

4 to one

20 per cent

20 2 2

2

20 20

2 20 20

20 2 20 20 20

20 20 20 20 20

20 20

10% 10%

10% 10% 10%

10% 10%

10% 10%

3 hours

Central Station

150 for a machine for

25 lights

$ 6.

Conductor outside Esti 2.

Lamp 3.

1 Lamp capital $11

300 hours a year

~~300)11.00(~~

~~3.66~~ cent

$ 1.10 interest

300)1.10

.00366

3.66 mills per hour

100 machine 20 lights

45

5

8

10

87

87

5

40

10

397

$ 25 a H.P.

Boiler

Engine $25 a H.P.

$25

$19. $ 2

$18 a lamp

$18.00

$300\overline{)1.80}$

.006 mills per hour

$19

$\overline{)1.90}$

1.90   0.
365   2.

$ 10000000

500000000 1000 feet

100,000,000 burners an hour

~~10000000~~

~~1000000000~~

$\frac{1}{10}$

~~1.000000~~

~~500000000~~

$ ~~10.000.000~~

~~500.000~~

~~1000~~

~~500.000~~

$2

$\frac{\$10}{5}$ $2 a year interest

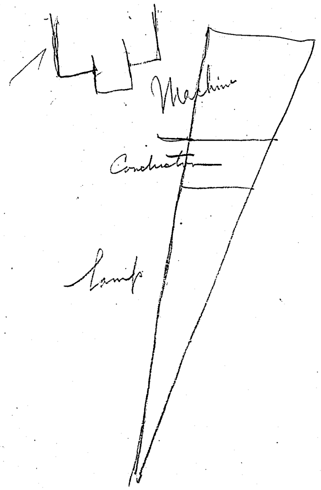
500,000

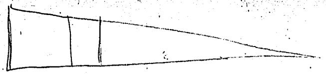
1,000,000

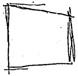
500,000

100.000.000

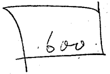
200000

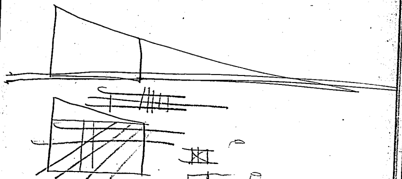




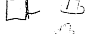


1 House

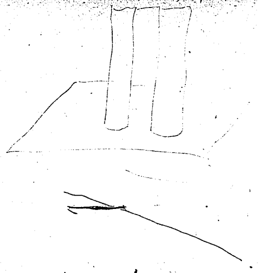




How much



Howmuch will the E.M.F drop when one lamp is ... or many?



1 in 10

1 ohm machine
100 ohm lamp
1 ohm in conductor for
10 lamps

D in Lamps 5 units
D in mach 1 un
— 1/2 unit

5 10
1 2
1
100
13

13)100(78
91
90
78
156
7.8
4

10 ~~9~~ 1 — 13

5 ~~7~~ 1 — 2

No. 1

Lamps 10
conductors 1
machine ~~8~~
1~~9~~ units

12)100(~~8~~3
96
40

83

12 units of

12)100(8.3

83
8.3
8.3

18

5 — 10 lamp

1 — 2 Machine

1/2 — 1 Conductor

13

13) 100 (7.7
91
90

7.7

7.7 lamp
15.4 machine
7.7 Conductor

1/2 Ohm Conductor
1 Ohm machine
100 Ohm lamp

77

77
15
7.7

23

---

1 lamps   100   50

100 = diff   9   1/2

50
1
2

103) 1000 (.0097
927
730

2 lamps 97

53)100(1.88
53
470
424
46

= 0

50 150
1 2
1/2 1

25 50
1 2
1/2 1

1.88
50
9400

103)100.0(97
927
730

53

53)100.0(1.88
53
470
428
420

1,88
50
9400

25
1.
2

3 lamps 94

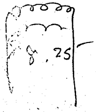
94

8 lamps

12.5 lamps
1/2 conductor
1 mach

25
2
2
28)100(356
84
160
140
200
168
32

357
25
1785
714
8825



16 lamps

100

12.5

25	6.25	Lamps
2	1/2	conductor
4	1	machine

.31) 100 (322
93
70
62
80

322
25
1610
644
80.50

1 lamp
1000 99
1 Ohm machine & conductor

2 lamps

50
1
51

51) 100 (196
51
490
459
310
306
4

1.96
50
9800

4

25
1

26) 100 (384
78
220
208
120

100
384
9616

~~384~~

8

12.5
1

27) 100 (37
81
190
187

37
25
180
72
900

16)

6.25
1.
7.25

25
4

29) 100 (344
87
130
116
140

31
25
155
62
775

31

(34400
86

.4 (37
9.22

20 lamps

$$\frac{5}{\frac{1}{6}}$$

$6) 100 (1$
166

1.66 — $\cancel{6}$ 77
5
833

83 lamps
8.5 conductor
8.5 machine

1/2 1/2

~~99.3~~ 2

~~100~~ ~~100~~

$$\frac{50}{\frac{1}{51}}$$

$51) 100 (196$
51
490
459
310

100
196
98.04

25
1
26

4

$26) 100 (346$
88
120
104
160

100
346
9654

218

8 No 13

1250 813 13

8 in series 1 Ohm each

$\mathcal{E} = \cancel{64}\ 1$

$C = \frac{1}{8}$

Magnet strength

$= \frac{1}{8}$

Each magnet Cost $= \frac{1}{64}$.

8 magnets 64 ohms in multiple arc

in each

$\frac{1}{64}$ = current

$\frac{1}{64} \times 64 = 1$ strength

Cost $\frac{1}{64}$ the same as before while strength of magnet 8 times greater

$\frac{2\cancel{0}}{700\cancel{0}}$

$700)\ 2\ ($

$\frac{1}{350}$ Weber

$\frac{1}{350} \times \frac{1}{350} \times \frac{2\cancel{0}}{\cancel{7000}}$

$\frac{2}{35}$ $\frac{1}{17}$ Erg

1 Ohm 1 cell
2 Ohm

$\frac{1}{4}$ Weber.

$\frac{1}{16} \times 4 = \frac{1}{4}$

$\frac{1}{2}$ $\frac{1}{8}$ Strength

$\frac{1}{\cancel{350}} \times \cancel{7000}$

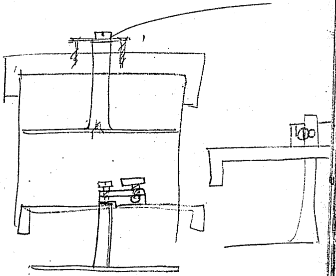
20 = Strength
of magnet
40 times as strong
160 times better

2888
2780
2

$$\begin{array}{r} .4606 \\ .4440 \\ \hline .0166 \end{array}$$

Make 3 buttons the old way –

Sat. Sol. Caustic Soda



8
8
1648
44.3
64
1772
2658
28) 2835.2
28
35
28
72

168) 1650 (8
1344
306

168) 1650 (98.2
1592
1380
1344
360

(10100 ft lbs

9100

10000
8250
18250

16.5) 1.000 (

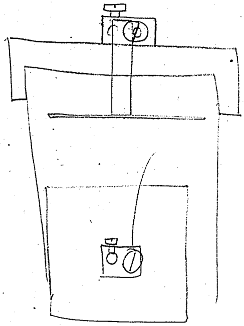
33000
5
165000
1825
47500
165000
18250
183250

183.25) 18.25

165000
8250
173250

173) 1000 (5.2
965
350

11



1.019 Ohm

1.019 Ohms

Ohm 1.0196 Absolute

Kohlrausch

Of E.M.F measured on Ohm

1,02

$\frac{11.24}{1.02}$

1.0504
.0086
1.0418

11.24 Absolute

1.101

1.125

$8 \overline{)9}$
1.125

Armature

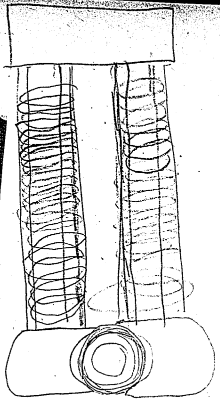
$$1 + \frac{a^2+b^2-c^2}{2ab}$$

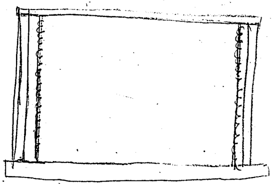
$$\frac{2ab + a^2+b^2-c^2}{2ab}$$

$a^2+2ab+b^2 = (a+b)^2$

$(a+b)^2$

a^2+b^2+2ab

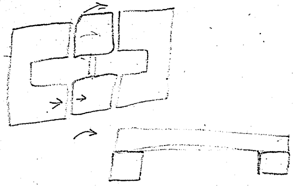


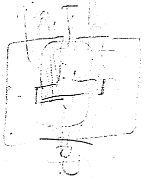


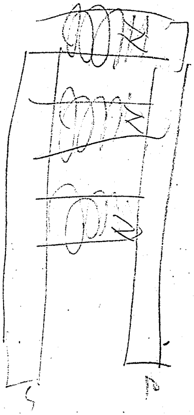
~~30 : 55~~

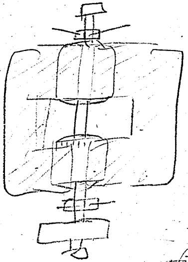
55 : 30 :: 25 :

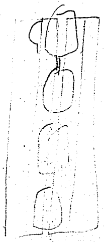
$$\begin{array}{r} 30 \\ \hline 55 \,)\, 750 \,(\, 13.6 \\ 55 \\ \hline 200 \\ 165 \\ \hline 350 \end{array}$$

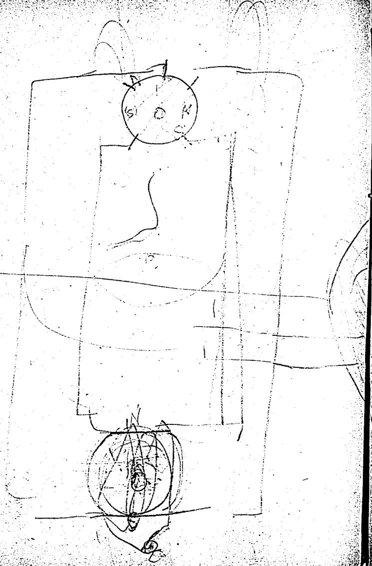


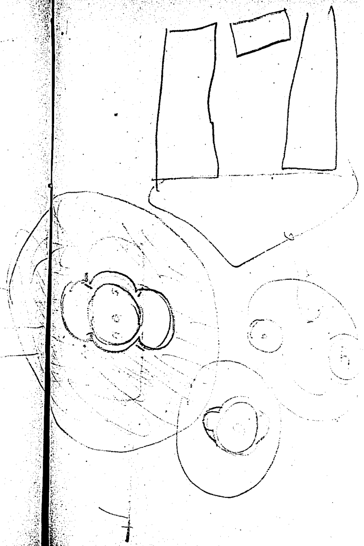


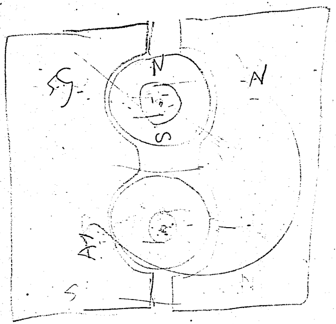

S
P

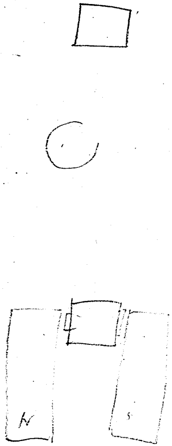


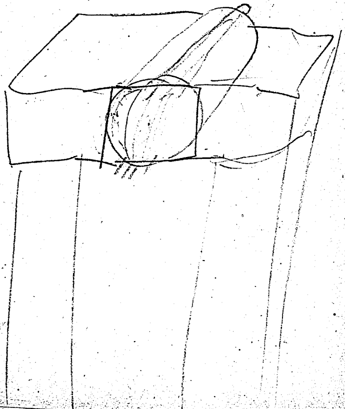


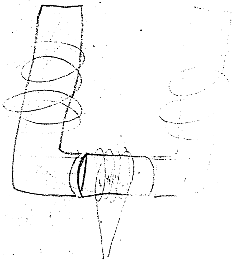





S
N
N
S
S
N


N
S

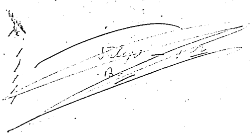




Pages torn out by (Lee Batch ms experiment or)

Multiply each numeral by 20 that is 1. 2. 3 4, 5, 6 &c

feet	$\sqrt{\ }$	( ) Number multiply by the 1:2	$(\ )^2$	$(\ )^2 \div 4$
1 20				
2 40				
3 60				
4 80				
5 100				
6 120				



D.
.01426   curve section .000162

$\bar{2}$.157600 $\bar{4}$.210200

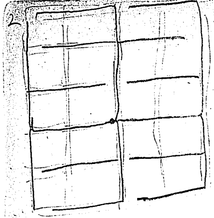
Menlo Park Notebook #7 [N-78-12-11]

This notebook covers the period December 1878-April 1879. The entries are by Edison, Charles Batchelor, and Francis Upton. Almost all of the material relates to experiments on electric lighting. Included are drawings of lamps; notes on filaments; drawings of generators, including one labeled "Edison 1st drawing"; comparisons to gas lighting costs; and calculations for an electric lighting system. There are also notes on chalks for telephones and a drawing of a Gramme machine combined with an induction coil for the telephone. The book contains 282 numbered pages and one unnumbered page.

Blank pages not filmed: 1, 76-77, 226-227, 246-275.

Missing page numbers: 233-234.

2



2000	1
1000	2
500	4
250	8
125	16
62 1/2	32
31 1/4	64
15 3/4	128
7 7/8	256
3 7/8	512
1 7/8	1024
7/8	2048
7/16	4096.

20
.4
1600.000 4

600

400 8
8 16
16 3200

3

Dec 11 1878

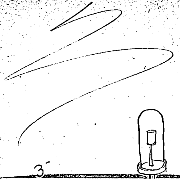
3/8

T A Edison

3/8.

1/8

8)3000



3

Edison Laboratory Note Book No. 7.

Page 3.

Edison's Incandescent Electric Light.
See Edison Patents:

214,636	227,227
214,637	227,228
218,866	227,229

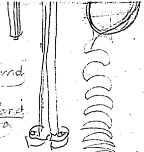
156
25
780
312
3.900

Portland

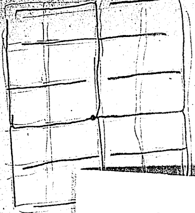
Portland

4600000000

Boston



2



31 1/4	64
15 3/4	128
7 7/8	256
3 7/8	512
1 7/8	1024
7/8	2048
7/16	4096.

6.00

400 8
~~8~~ 16
16 32 00

Dec 11 1878

3/8.

T A Edison

3/8. 1/8

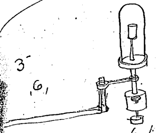
8) 3000
375

375
5

6) 1875.
312.3

3"

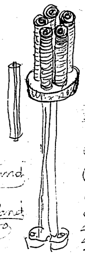
6

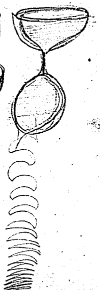


156.

2000,

Batchelor





156
25
780
312
3900

Portland

Portland

4600000000

Boston

S L

S L

S L M T

Boston

Boston Griffin Twenty

Griffin Griffin

Griffin Engineering problems Griffcock

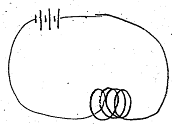
Tower

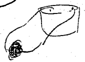
Engine Railway

Railway Transportation

Griffin

Dec 11 1878





Bohm,

1/10 of cp. 10 ti a Candle 150 ti a gas jet.

.3. 10 cells 1

1 cell to Candle.

64

2 cells	6 ohm	
4	$1\frac{1}{2}$	6./32
8	12/16.	
16	4/16.	3/32
32	3/16	
64		

6

5 5

25 2 5

11 Cells .2 Ohm 7

2.2

Dec 13 1878
Jaq

$$a = \frac{22}{2.2+5} = 3$$

$$= \frac{22}{7.2}$$

$$7.2\overline{)22.0}\ (3.$$
$$\underline{216}$$
$$40$$

$$\frac{4}{5}$$

$$c = \frac{22}{2.2+25}$$

$$\underline{15}$$

$$\frac{22}{27}$$

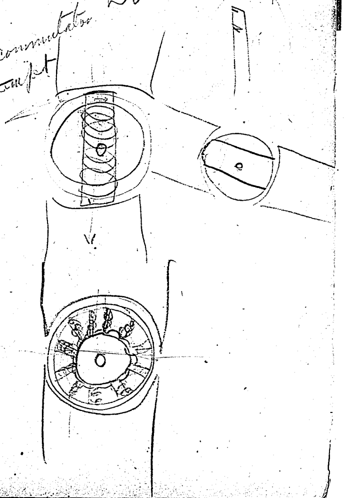
$$27\overline{)22.0}\ (.81$$
$$\underline{216}$$
$$40.$$

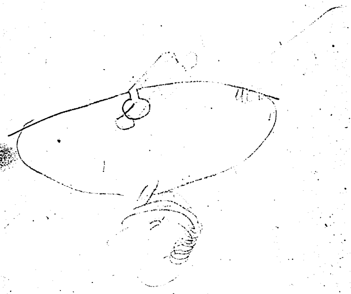
3 cu. inches

ages 9 to 27. "Dynamo Sketches" (Unimportant)

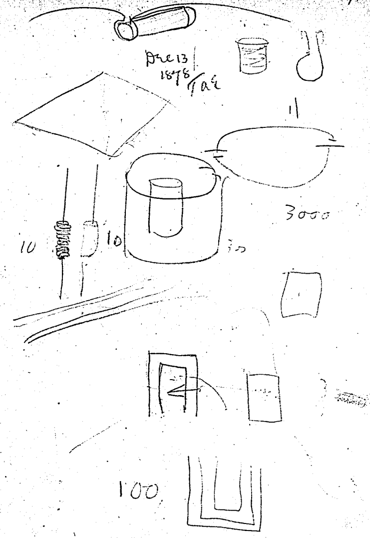
Dec 13 1878 TAE

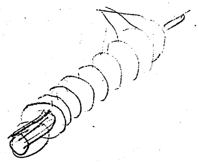
Non commutator attempt

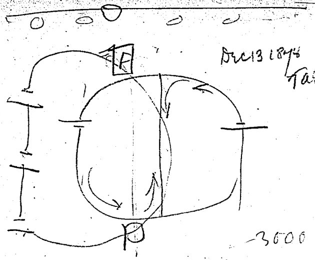




Dec 13
1878
TAE



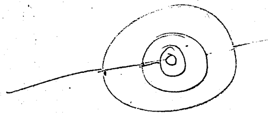


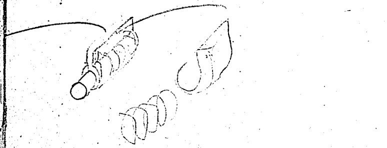


Dec 13 1898
TAE

-3000

30-00





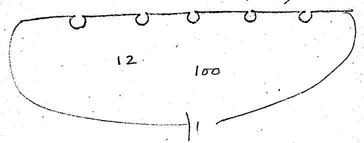
4 $\frac{1}{40}$

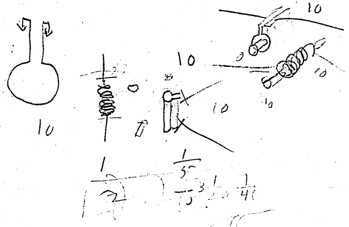
~~8~~

~~10~~

1	$\frac{1}{5}$	10000	2000
2	$\frac{1}{10}$	5000 2	1000
4	$\frac{1}{20}$	4	500
8	$\frac{1}{40}$	8	250
16	$\frac{1}{80}$	16	125
32	$\frac{1}{160}$	32	$62\frac{1}{2}$
64	$\frac{1}{320}$	64	$31\frac{1}{4}$
		128	$15\frac{5}{8}$
		256	$7\frac{1}{2}$
		512	3
		1024	$1\frac{1}{2}$
		2048	.62
		4096	31
		8192	15

Dec 18 1878 TAE





1 $\frac{1}{5}$ $\frac{1}{10}$ $\frac{1}{20}$ $\frac{1}{40}$

10000 — 2000
5000 1000
2500 500
1250 250

16

$\dfrac{1120600}{672000}$

6

2 $\frac{1}{30}$ ft per min

1120 | 196000 | 176|600
1120
8400
7840
600

17

1 = 1 =

Dec 13 1878 TAE

$C = \frac{e}{r}$

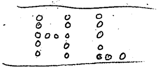
$C = \frac{e}{r} = \frac{25}{30} = .83$

$C = \frac{e}{r} = \frac{50}{4}$ 12.50

30 | 25.00 | 0.83

25.

30



1 ton Coal 10000

340 lbs. 10.000 40 000

5 ft = 15 candles 60 min 900

40000

5 : 900 40000

5 | 63000000

6 | 1.26 00000

210.000

210 000.

18

30000/391

Electric Light Dec 17 1878

2240
1341
9.00 Cost gas &c

~~10000 ft an 9.00~~ coke

1300 lb coal = 10'000 ft gas thr
for age bar
= 2'000 gas jets
= 30'000 candles
= 650 horsepower

650 horsepower = at 600 candles
per ~~HP~~ = Jablochkoff candles
390.000 or 13 times
more than gas.

Taking into consideration the
consumption of carbon as
twice as much as ~~H~~.P. in
Jab. Candle it would be
$4\frac{1}{3}$ cheaper than gas

Over

11^2 per HP

$4^2 = 1$ " 650 90

58500

Electric Light

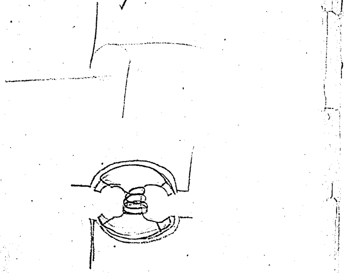
Dec 14 1878

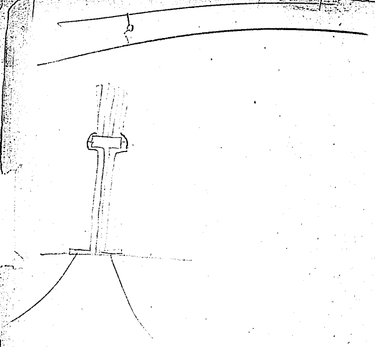
We get 6 lights per HP 17

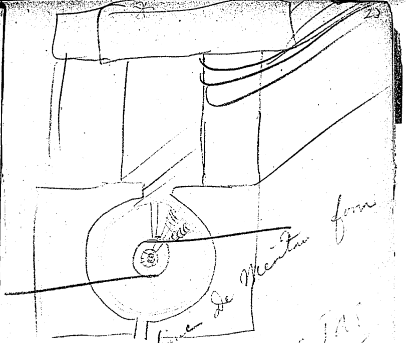
90 can. per HP we should

have 58500 candles

~~Theoretically 1 HP~~



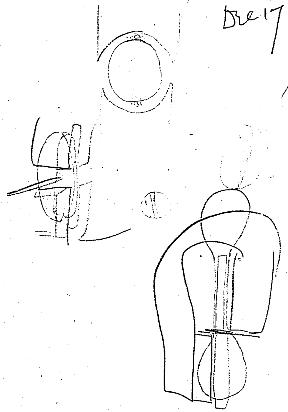




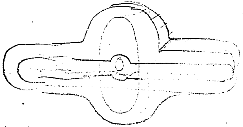
Dynamo machine De Meritens form

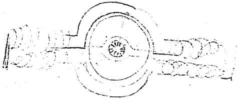
Dec 17 1878 TAE

Dec 17 1978
JAE



Dec 17 1878
TAE





Dec 17 1878
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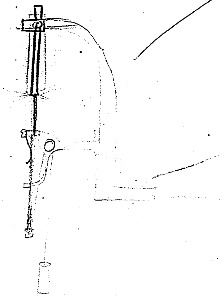
Shades Lamps



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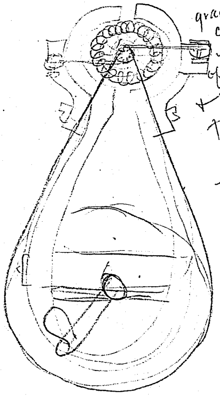
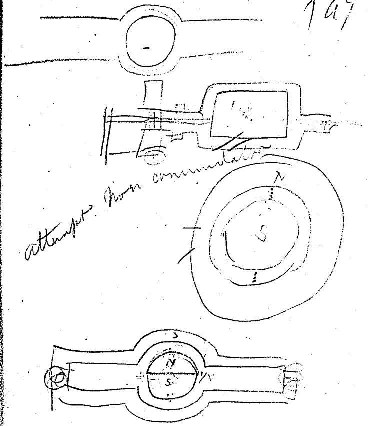


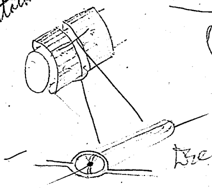
gramme Mach
combined with
induction coil
of Carbon telephone
+ Motophone
Telephone

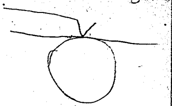
Dec 19 1878
TAE



attempt Brush commutator

Commutator





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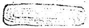
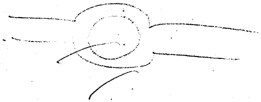
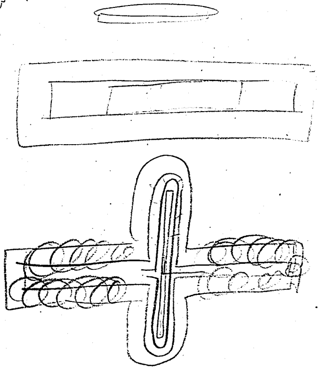
CTae





Siemens form of

Dec 17 1878 / TAE



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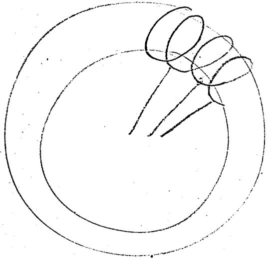
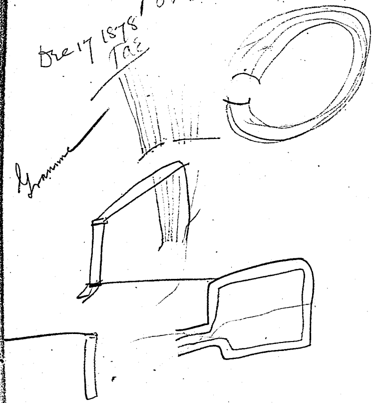
Gramme ring

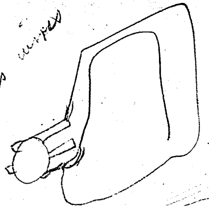


500 / 1000   .002 cross section
.001 "

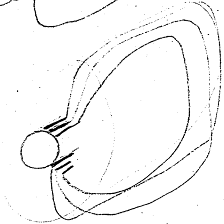
Dec 17 1878
TAE



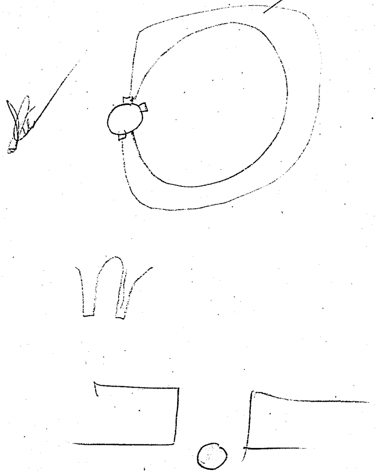
Siemens [illegible]



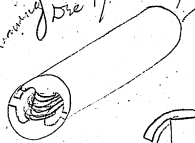
Dec 17 1898
TAE

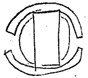


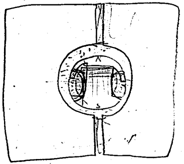
Dec 17 1878 Tue



Edison pat drawing Dec 17 1878 T.A.E

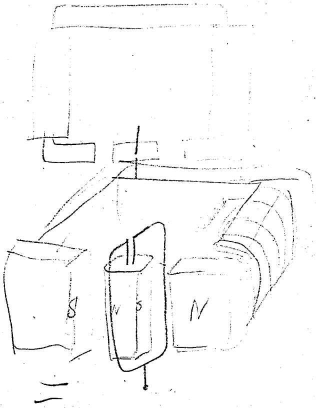


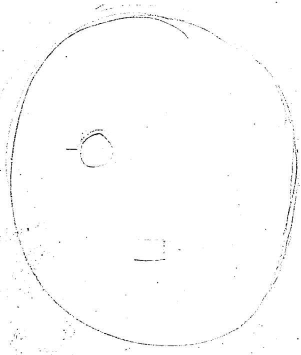




Siemens form of

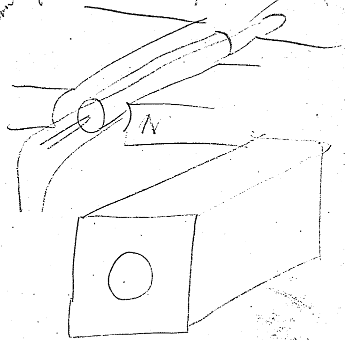
Dec 17 1878
TAE

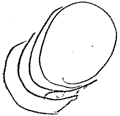




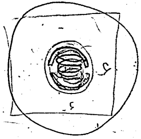
Edison dynamo

Dec 17 1878
TAE





Edison dynamo



Dec 17 1878
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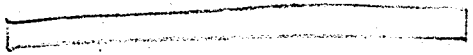
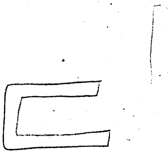
15.

3

3 feet 4 inch

2 1/2 [illegible]





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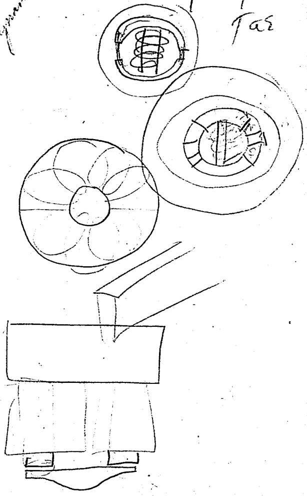
Edison dynamo



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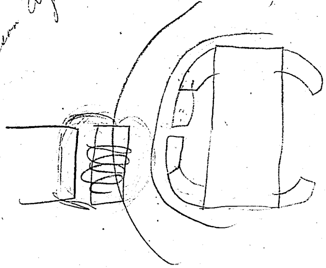
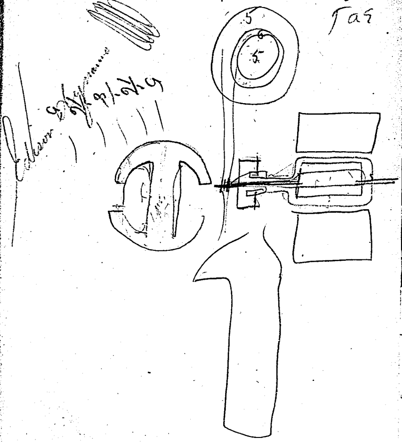
Edison dynamo



Dec 21 1878

Jas



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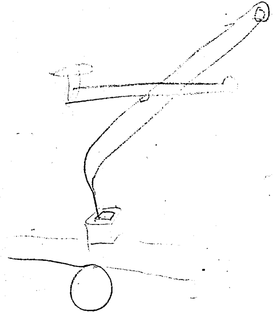

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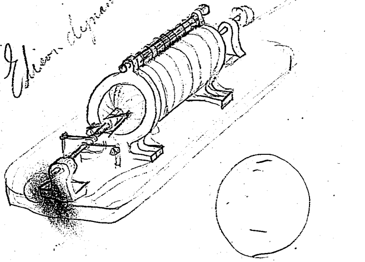
Dec 29 1878

Edison dynamo



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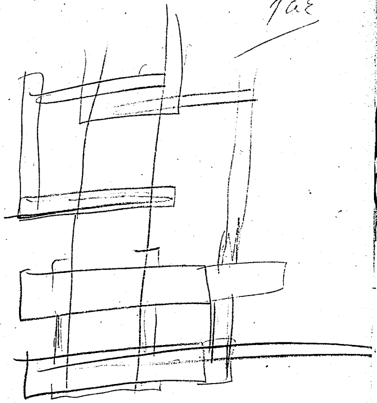
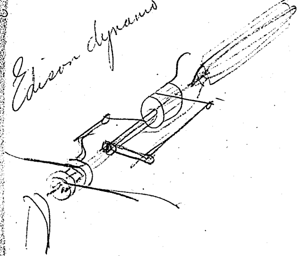
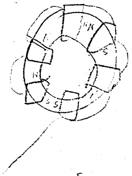
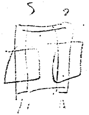


Dec 29. 1878 fas

Edison dynamo





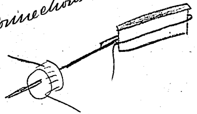


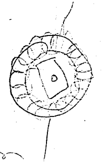
Edison's Magnet Electric Machine

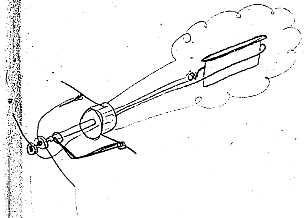
Dec 31st (1878?)

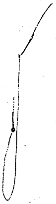
Chas Batchelor

Connections









Dec 31 1878

556, Paid

5) 143,
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28
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30
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150.

28, hours.

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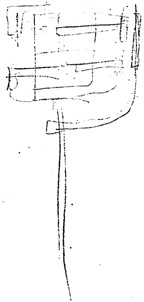

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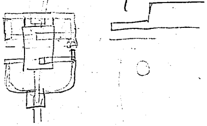
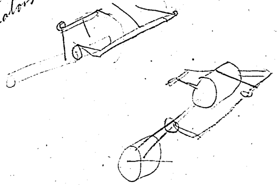
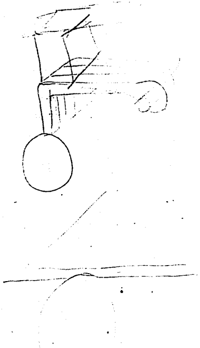
TAE

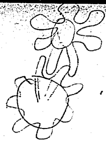


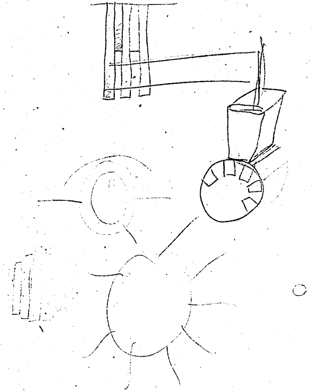
E- dynamo
Commutators

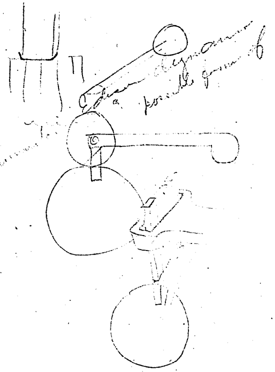




Jany 1 1879
Tar







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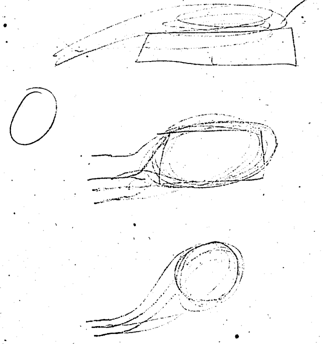

Jan 1 1879
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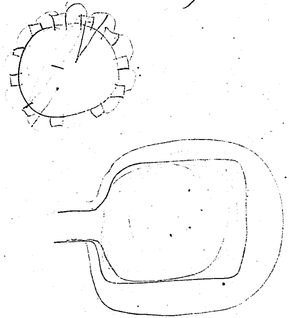
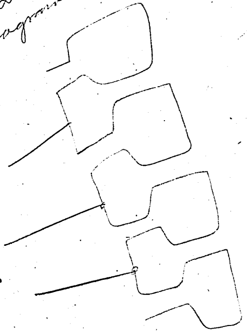
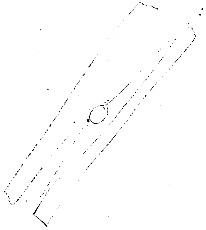


~~Dec~~ Jan 1 1879
TAE

Loops Diagram





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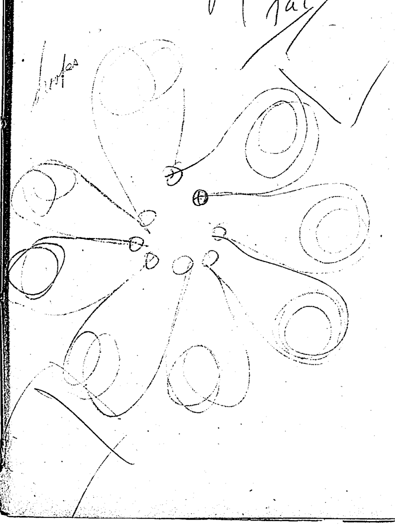

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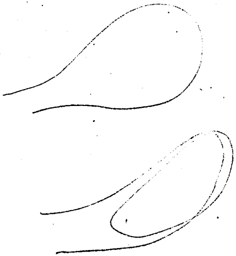
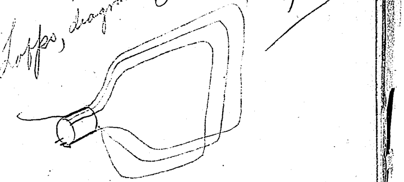
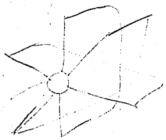
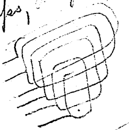


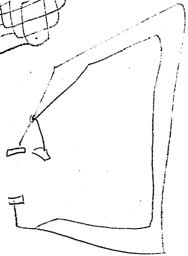
Loops, diagram of January 1 1879
TAE

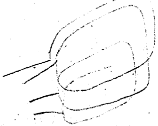




Loops, diagram of



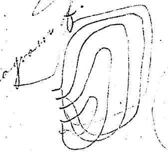


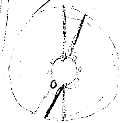


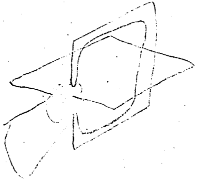
January 1 1879

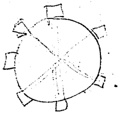
TAE

Loops, diagram of

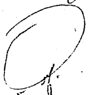




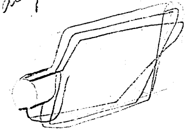


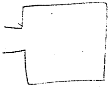


Jany 1 1879
TAE

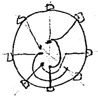


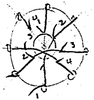
Loops, diagram of.



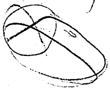


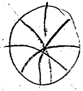
Loops course of currents

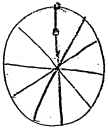


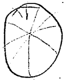


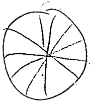
Loop connection Jany 1 1879 TAE





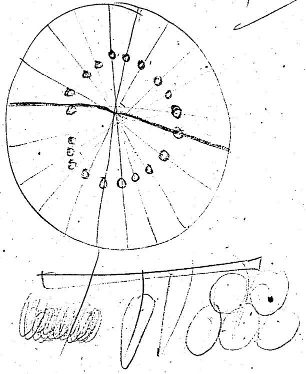




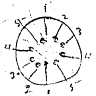


Commutator Jany 2 1879

TAE



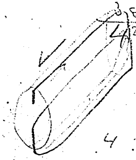
Commutation Connections in



14500
772

296
385
355

4264000

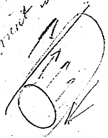


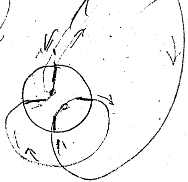
4 264000
210000

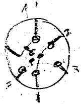
1/20

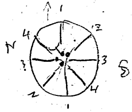
Current in loops

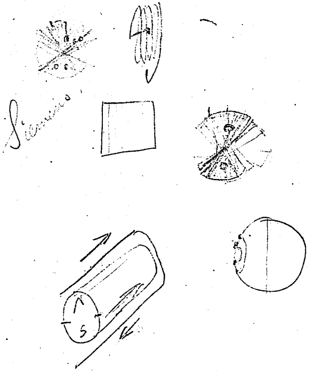
Jany 2 1879
TAE



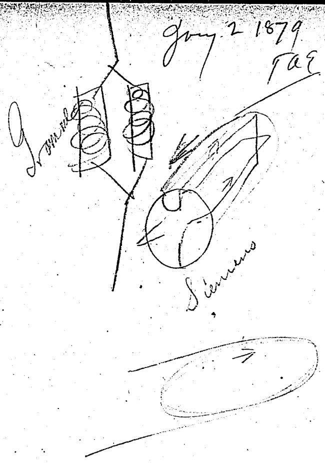






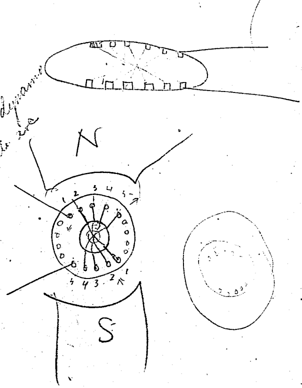


Jany 2 1879
TAE



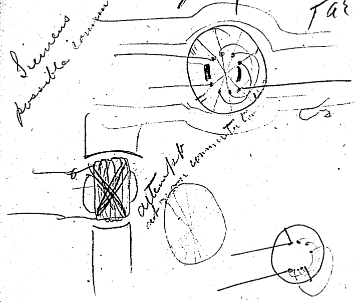
Jany 2 1878
TAE

Edison dynamo
multiple coil

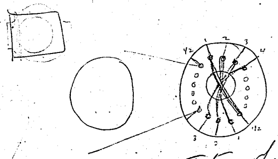


Jany 2 1879
TAE

Siemens
possible commutator



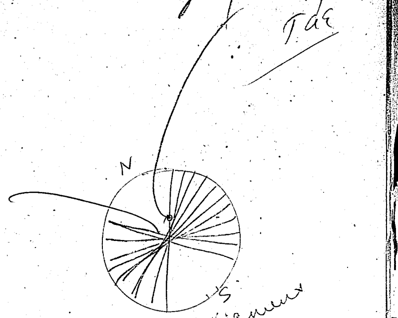
attempt
at Siemens commutator



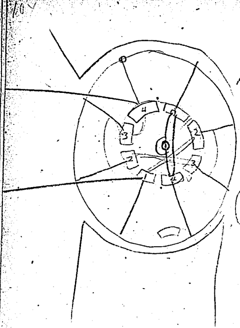
Commutator Siemens

Jan 2 1879

TAE



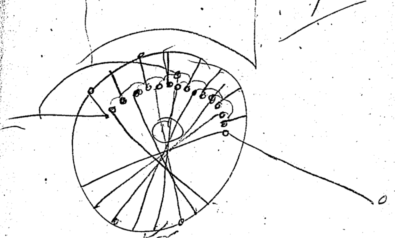
Commutator Siemens



Commutator possible Siemens

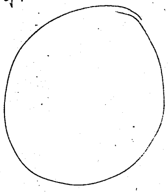
Jany 2 1879

TAE



Commutator possible Siemens.

A Grand Potentiality.



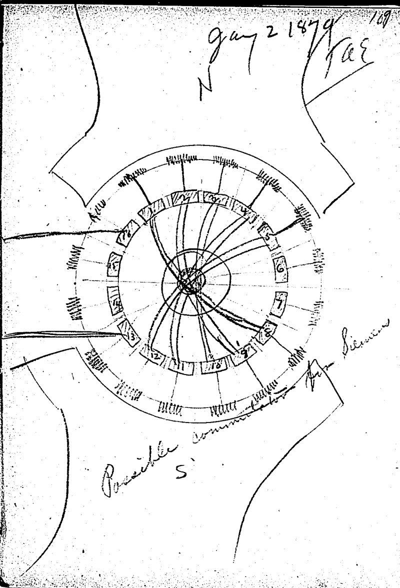
12.50.

35
30
1050

35
50
1750.
1050.
2800
2800
850
500
500

Jan 2 1879
TAE

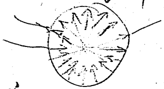
N

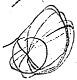


Possible commutator for Siemens
5'

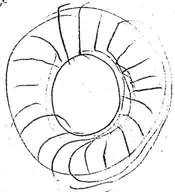
Jany 2 1879

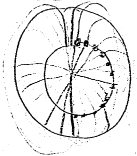
TAE





Gramme Siemens resemblance

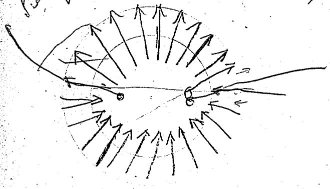


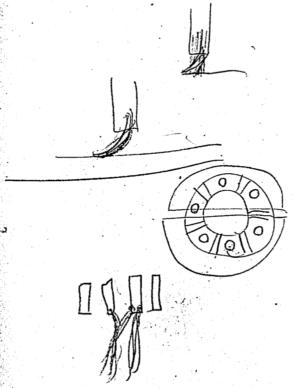


January 2 1879

TAE

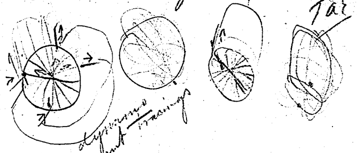
Siemens currents in



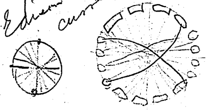


January 2 1879

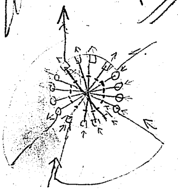
TAE

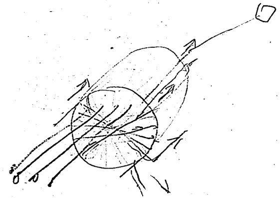


Edison dynamo current drawings



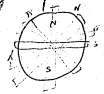
This

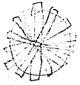


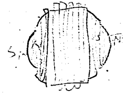


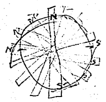
Jany 2 1879

TAE



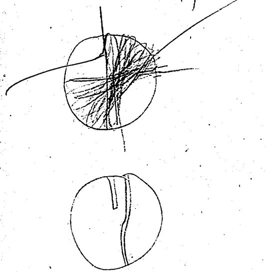




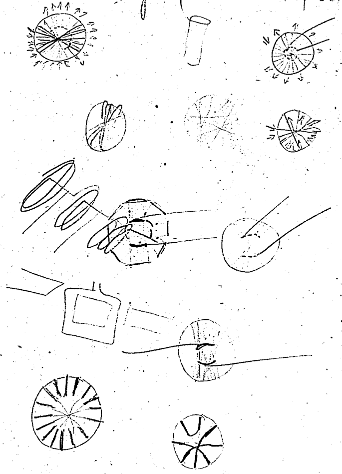


Jan 3 1879

TAE



Jan 3 1879 TAE



Portland.

20) 1000.

50

200
20
4000.

Chicago

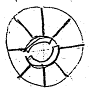
Chicago Chicago

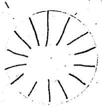
Portland

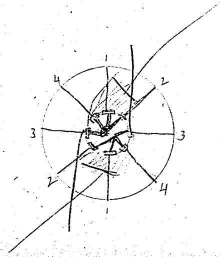
Jany 3rd 1879

TAE

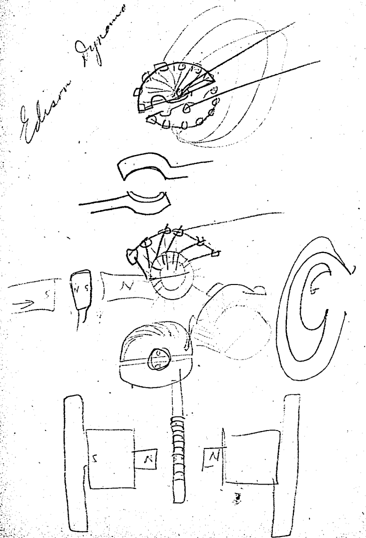
Edison Dynamo







Edison Dynamo



Jany 7 1879

Lamps

3/4.

4

2

250

75

375

185. inches

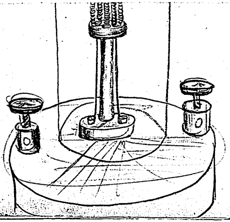
Edison Laboratory Note Book No. 7.

Pages 135 to 137.

Incandescent Lamps!

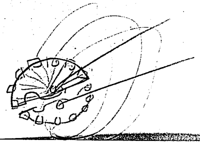
See Edison Patents:

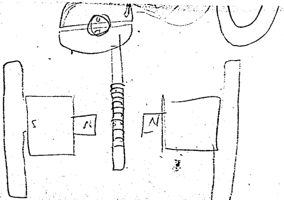
214,6[illegible]	227,227
214,637	227,228
21[illegible],6[illegible]	227,229



126

Edison Dynamo





Jany 7 1879 135

Lamp

3/4.

4

2

25.0

75

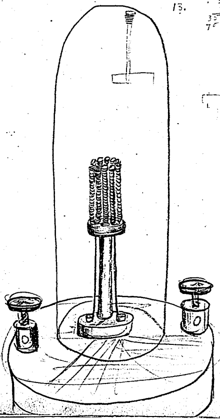
375

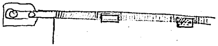
185. inches

13.

350
7
3500
750

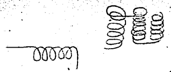
12.



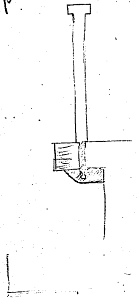


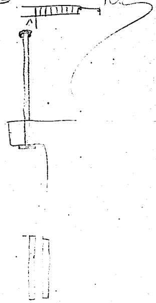
Jany 7 1879

TAE



Lamp

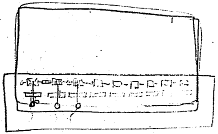


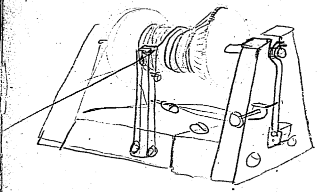


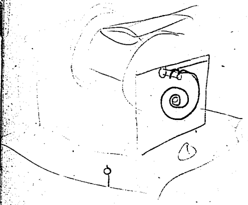
Pages 141 to 149."Rheostat Sketches" (Unimportant)

Aug 7 1879

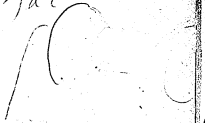
TAE

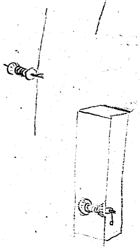


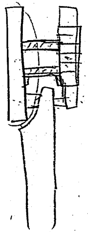




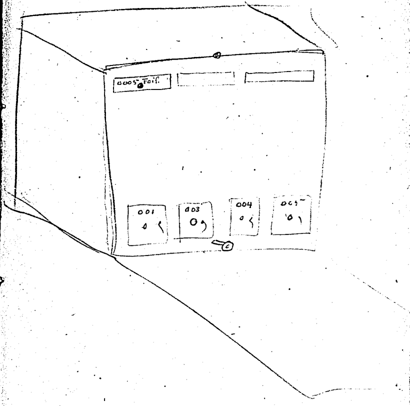
Jany 7 1879
TAE







Jany 9 1879
TAE



8
16
32
64

4
8
16
32

60, 20, 40, 2, 4

120

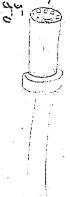
Tas

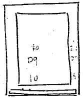
.004

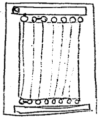
.004 = .00125
.4 = .125
.004

.004 = 1.25

Resistance

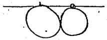






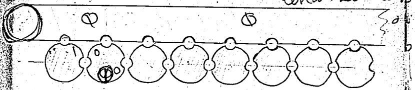
.004

5.



Resistance wires

Jan 9 1879
Chas Batchelor

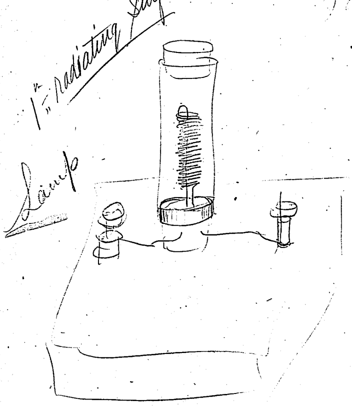


20 wires = 20 ohms
or in multiple are ·05

Resistance

Pages 151. "Sketches & Calculations" (Un[illegible])

Jany 9 1879
TAE



.36
55
180
180
19.8

.017

.017
3.14
068
017
051
.05338 20
.1067600

.018 / 1000

55) 20.00 (0.36
165
350
330

.12
100

17

20 inch length
40 " " "

.55) 4000 (0.73
385
150

.018

.12
.009
.111

.73
24

.24
009
.234
100

Jany 9 1879

Wire .017, in long
Spiral
Diameter .12
Number turns 55

16.
6
96

12.

.23
3.14
92
23
69
.7222

25
314
100
25
75
.785

33
31.4
132
33
99
1.0362

.33
.134
.296

50.

72
5

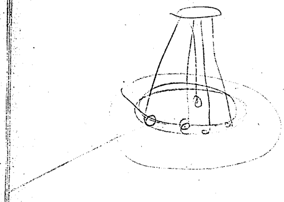
6.

6) 576 (9
440

54
12
108
54
648

16

40) 648 (16
40
248
240
8



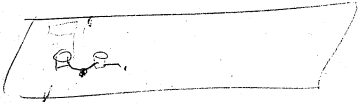
Jany 9, 1879
TAE

72
8

6)576(96
54
36

96
6
576.

3



36 : 10
20
36

1 2 : 1 36 2 : 1

10
62
20
60

135

Screw 10 ~~to inch~~ Spindle 18 Enter shaft 27

Gears. 20-24-30-32-40-44-
48-52-56-60-64-126

Thread wanted 166

54 40-48 — 20-60

156 = 20-60
24-126

189 threads 20-60
20-126

126 = 20-60
30-126

Jany 9 1899
TAE

60 126
20 20
60 126
20

166

189

1260
39 . 3

157

166

111 . 10

34
126
10

Jany 9 1879 TAE

135 threads - 20 - 60 wheels
20 - 60

166 = ~~17.21 20 60 = 34 126~~

$\boxed{157 = 24 - 60 - 32 - 126}$

189 = 20 60 - 32 126

160 Jany 9/1879 TAE

Question. How can voltaic cells be arranged in multiple arc and what effect will they produce.

Laws. The votaic cell indicates only the current, or as it is called the quantity of Elec. passing through it, It is only another form of galvanometer. A number may be put in ~~line~~ series and each one will give an equal amount of gas no matter what the surface of the platinum or the resistance in any one is. This will be only true when the current has been passing ~~to~~ for a time sufficient to saturate all the various platinum electrodes with gas.

The "hindrances" ~~may~~ to the passage of the current are two-fold. First the resistance of the water as a conductor. Secondly the opposing electromotive forces set up ~~in~~ the surfaces of the immersed plates.

The resistance may be measured in two ways, making it first say one inch and measuring the current, then two inches and measuring. The difference will ~~solely~~ be due to the added resistance for the greater part. It can also be measured ~~in~~ by the method used by

That is to send

rapidly reversed currents
through the water and
measure the by an electro-
dynamometer. This method
takes for granted that the
polarization is zero for such
currents.

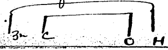
The resistance of the decom-
posing cells will directly be
a dead loss for the current
will be used in heating
it. Indirectly it may
be utilized for the heating of the
water ~~thus making~~ makes
the gas come off more
readily and also warms the
gas and makes its combus-
tion better.

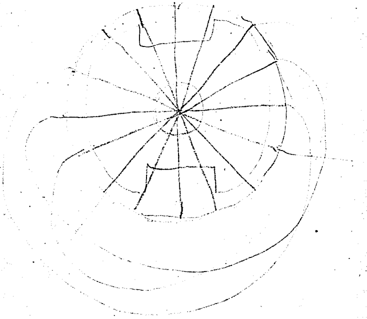
The electromotive force
of a water cell when the
poles are covered with H_2O
is about 1.2 Daniells
Sprague gives it at
1.464 Volts a Daniell
being 1.079 1.8 Encycl Brit,

1.464 .165541
1.079 .031004
1.363 .134537

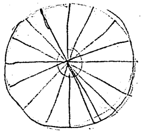
1.363 Daniells

The H is carried with the
current the same as a metal
and thus the O will be
found at the pole connected
with the + of battery and H
with that of the −





January 9 1879
TAE



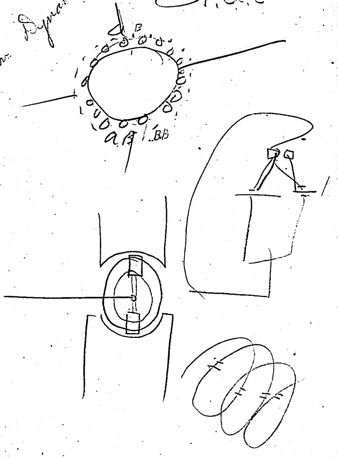
January 9 1879
JAE

Pages 169 to 214, "Dynamo Notes" (Unimportant)

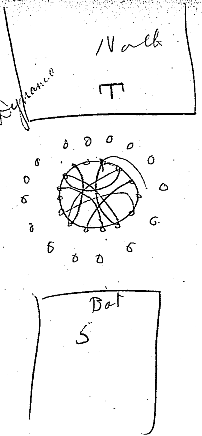
February 16 1879

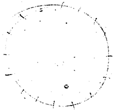
A.a.E

Edison Dynamo

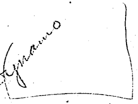


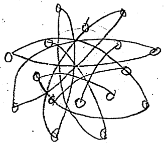
Edison Dynamo

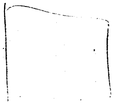




Edison Dynamo





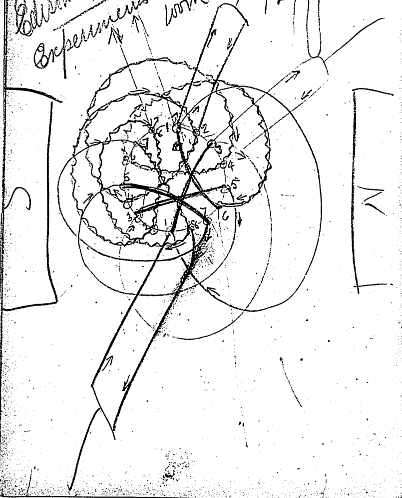


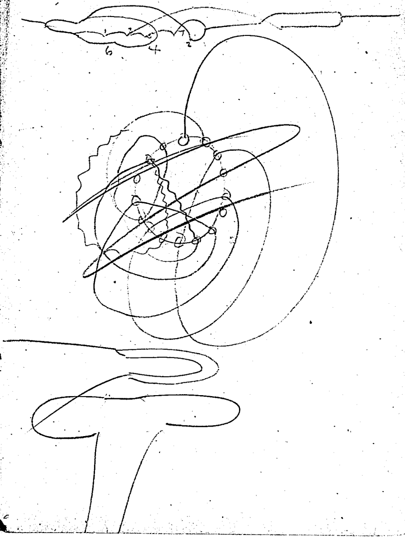
Feb 15 1879

Edisons Magnets

Experiments & make this work

Batchelor

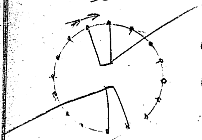




Exp 1 page 174 Feb 15 1879 Chs Batchelor

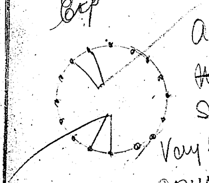
Commutator Springs &c

Exp 1



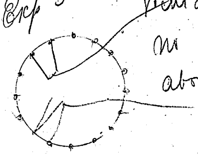
Went all round
no current except
a shock at each
revolution

Exp 2 Bad



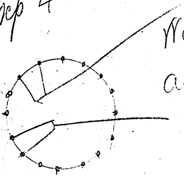
All round
~~no current at~~
Slight spark,
Very little spark at
Commutators

Exp 3

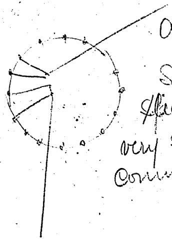


Went all round
no better
about same

Exp 4

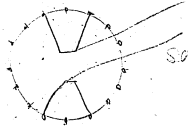


Went all round
about same

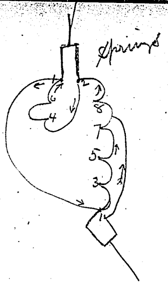


All conns

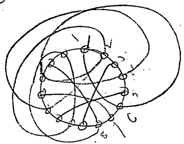
Same
slight spark
very small spark on
commutator

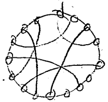


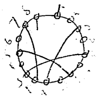
all conns
same as before



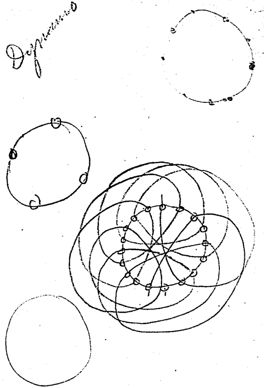
Edison dynamo



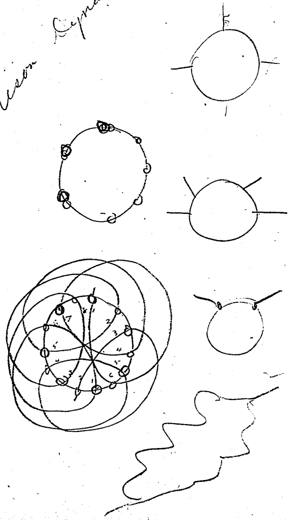




Edison Dynamo

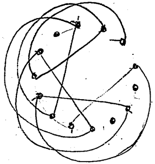


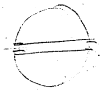
Edison Dynamo

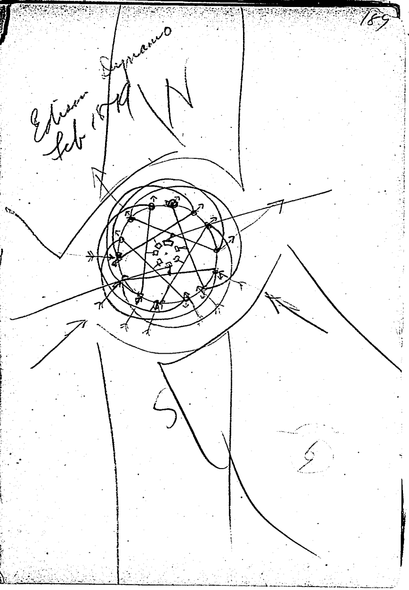


Feb 1879

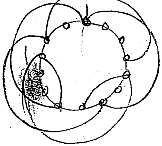
Edison Dynamo

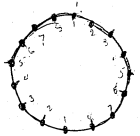


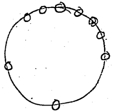


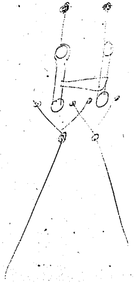

Edison Dynamo
Feb 1879
N
S

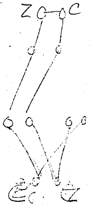
Edison Dynamo

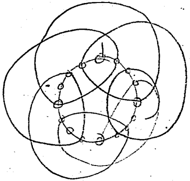


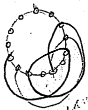


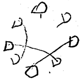




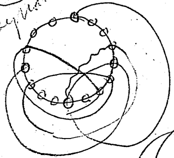

Z
C
C
Z

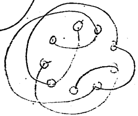


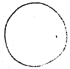




Edison Dynamos



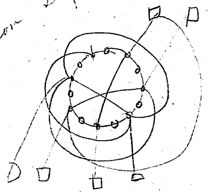




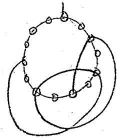
196

197

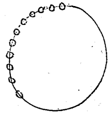
Edison Dynamo

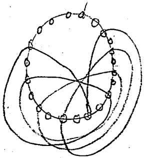


Edison Dynamo

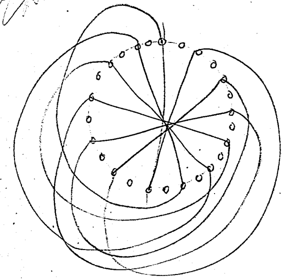


Edison Dynamo





Edison Dynamo Magneto



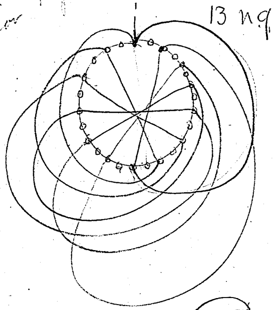
13

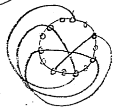
6

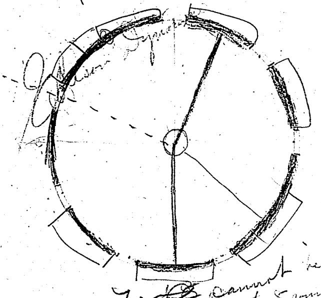
4 3 5.7.
8
1.2

Edison Dynamo

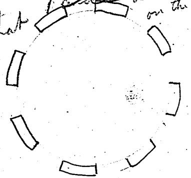
13 nq.



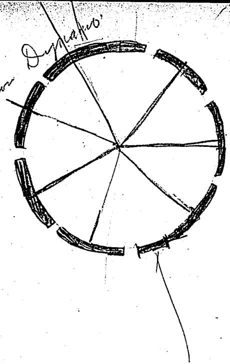




Proof that [illegible] cannot be used on the 8 commutators



Edison Dynamo



214

46
3

728
3
2184

36.
60
2160

46
3
138
[illegible]

60 Rev

fly wheel 12 feet

46 inch pulley.

runs 188,1.

728
6
4368

728.

188
46
1128
752
8648

12) 8648 (728
84
24
24
8

Feby 24 1879. 215

I find that acetate Lime, magnesia
Chloride of lime, Magnesia or
Alumina will not coat iron
wire by immersing in liquid
[illegible]

Edison Laboratory Note Book No. 7.

Page 215.

See Edison Patents:

214,636	227,227
214,637	227,228
218,866	227,229

[illegible]
Solution of Magnesia
acetate & pulling [illegible]
of same after [illegible]
time.

46

728
3
2184

36.
60
2160

4368

46 inch p

runs 188,1.

728.

188
46
1128
752
8648

12) 8648 (728
84
24
24
8

I find that acetate Lime, magnesia Chloride of lime, Magnesia or Alumina will not coat iron wire by immersing in liquid & then heating & repeating the operation many times But platina is coated easily - a Beautiful hard Coating that very smooth is put on platina with immersing it in a Syrupy Solution of Magnesia Acetate & putting in flame after each time.

Pages 217 to 228. "Notes on [illegible] Telephone [illegible]." Unimportant.

3 oz. Chalk (precipitated)
9 grains Acetate Mercury
1/2 fluid oz. Caustic Soda 1

3 oz Chalk
5 grains Acetate Mercury 2
1/2 fluid oz Caustic Soda

3 oz Chalk
No Mercury 3
1/2 fluid oz Na.O.

3 oz Chalk 4
15 grains Acetate
1/2 fluid oz Na O

3 oz Chalk 5.
25 grs Acetate Mercury
1/2 fluid oz Na O.

3 oz Chalk
40 grs Hg acetate
½ fluid oz Na.O. — 6

---

3 oz Chalk
100 grs Hg Acet.
½ fluid oz Na, O. — 7

---

3 oz Chalk
9 grs Hg Acet.
¾ fluid oz Na, O. — 8

---

3 oz Chalk
9 grs Hg Acet.
1 fluid oz Na, O. — 9

---

3 oz Chalk
25 grs Hg Acet
1 fluid oz Na O — 10

3 ℥ Chalk
1 ℥ Na O. // Mercurous "Acetate" sparingly soluble in water!

~~The Chalk and Acetate Hg to be ground up very finely~~

Dissolve ~~the Acetate Hg~~ in hot water sufficient to just wet the whole of the Chalk "to mix with the chalk". It must be ground thoroughly so that every part of the chalk is wet, afterwards the chalk is laid out to dry without heat, after drying it is put in a mortar and the Caustic Soda poured on it and thoroughly ground and allowed to dry so that it is just damp only to the touch, In this condition it is to be put into a bottle and closed and labeled

March 17/79

J. Lawson

Pulverized the Mercurous Acetate finely in a mortar, sifted, and mixed intimately with ~~the~~ calcium carbonate by placing ~~layers in~~ sieve, then sprinkling thin layer of Mercurous acetate, then layer of Calcium Carbonate, and so on, and sifted the whole [#60 sieve.

Repeated the sifting process three times, each time mixing more intimately by means of spatula.

Added con. sol. of

Sodium Hydrate with enough water to make the whole of the consistency of dough, ground thoroughly [volume of sodium hydrate and water 60 c.c.], then set aside to dry.

228

75 .75

25

6

1.9
.9
.51
1.6
1.1
1.57

9

9

3
3
3000
3000
3000

229

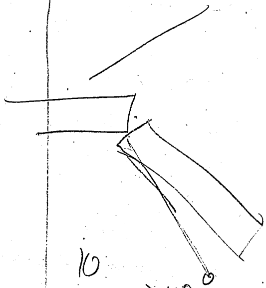
.6 External
1 Carbon cell
2 Volts .2 internal
40 bars 2 Volts
1.0 Internal
.6

$C = \frac{2.0}{1.6} = \frac{5}{4} = 1.25$

$\frac{25}{16} \cdot 6_3 = \frac{75}{8} = .94$ E

Carbon $\frac{2.0}{.8} = \frac{10}{4} = \frac{5}{2} = 2.5$

$\frac{25}{4} \cdot 6_3 = \frac{7.5}{2} = 3.7$ Energy



10

.772

75°

75
50
3750

1

100)2000
20 per hour

3750
2000
7,500,000

33 ~~000~~)7,500,~~000~~ ft lbs
66 ~~3~~ 20
90
66
240

60)224
3.73

772 ft lbs
lb H_2O 7

75. raised
5 00 raised
3750 per lb H_2O
2000
60) 7.500,000 ft lb per ton
1

33000 × 60 = 1980000
33000 × 60 = 1980000

~~1,980000~~) ~~7,500000~~

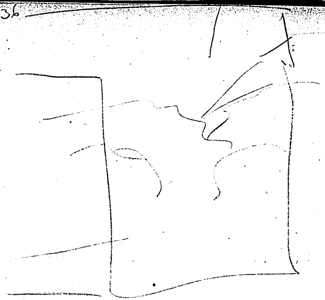
198.) 750. (3.7
594
1560

772
100
33000) 77.200 (
60

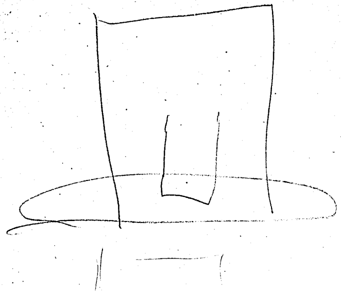
2 1/3
2000
4666

772
2000
100
77200
1554 ~~00000~~
198 ~~0000~~
198) 1554 (7

33000
60



200



Menlo Park
Apr 1879

April 6. 2 a.m.
Leclanché cell on 100 Ohms
45° = D

---

9 a.m.
15° = D
11. 30 a.m.
130

Open for evaporating

3 – 40 P.M
25° = D
4 - 5 P. M
15 = D

Taken off
8 – 40 P. M
27° = D
Polarized quickly

~~Taken off after 100~~
Put on 100 Ohms
8 - 20 D = 17°
Taken off

10–10 P.M

23° = D

~~To be put on alternate [illegible]~~

April 8

9–5 A.M

on all night

D = 10°

Taken off

1 Daniells

4½ = D

2 Daniells

9° = D

12 M

D = 27°

on until

1–35 P.M

D = 14°

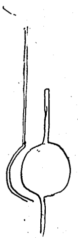
Taken off

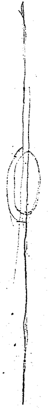
put 5–25 P.M

17° = D

9 P.M.
10° = D

Taken off
May 9
18° = D
Battery drying





Pages 245 to 275." B. L A N K".

1000

1+1

1+1+2
2+3+4

~~999~~

Pages 276 to 284."Lamp & Dynamo Notes, &c."(Unimporta

$$C = \frac{\varepsilon}{R + r}$$

$$= \frac{1}{1+1} = \frac{1}{2}$$

$$C = \frac{\mathcal{E}}{\cancel{R} + r} = \frac{1}{1} = 1$$

$$C = \frac{\varepsilon}{r} = \frac{2}{2} = 1$$

$$1000 = R$$

$$\frac{\mathcal{E}}{2}$$

12 inches of $\frac{9}{1000}$ wire,

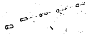
4 = $\frac{4\frac{1}{2}}{1000}$

$2\frac{1}{2}$

~~8~~

16 —

3/8



8

16 lights

20 7 300 66 turns $\frac{200}{3}$ 3600

1000 $\frac{600}{9}$

5 10. ohms. 36, 800 12000

2

32
64.

.25 ohm
5
125.

14000

25
10
141.

250
.2

16)200(12 1/2
16
40
32
8

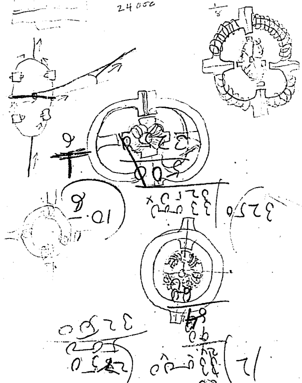
20
10
200.

24
8
192.

If this was wound in a flat spiral scant 3/8 by 1 inch. Each turn has 1 inch of wire, 500 turns without zircon could be put in but with zircon say 200 turns (i.e.) 200 inches now 200 inches would measure cold say 700 ohms when incandescing it would measure 3500 ohms — hence there is no difficulty in making a lamp having 2 or 3000 ohm resistance if the wire was $\frac{4}{1000}$ it would have say 800 ohm resistance

Dynamo Mac Drc

3000. 1
6000 1/2
12000 1/4
24000 1/8



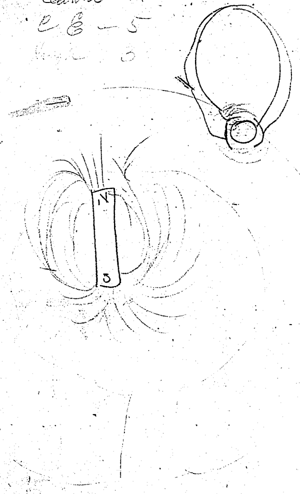
$\frac{2}{1000}$ wire 11 inches
actually measures 40 ohms

16 inch of 0 9000

or $\frac{9}{1000}$ measures 2 ohms at temperature of the atmosphere 62, at incandescent point it would measure 5 times more or 10 ohms — in $\frac{4\frac{1}{2}}{1000}$ it would have 8 ohms resistance, or 40 ohms at incandescing point if it was $\frac{2\frac{1}{4}}{1000}$ it would be 32 ohms, or 160 ohms at incandescing if at $\frac{1\frac{1}{8}}{1000}$ it would 128 ohms or 640 ohms at incandescing Is this OK —

Then 32 inches 1280 ohms
64 inches 2560
128 5120
256 10240 ohms

Earvm 1.
e 6 – 5



Menlo Park Notebook #8 [N-78-12-20.2]

This notebook covers the period December 1878-June 1879. Most of the entries are by Francis Upton. There are also entries by Edison, Charles Batchelor, John Kruesi, and George Jackson. All of the material relates to experiments on electric lighting. There are notes and calculations by Upton about meters, a series of tests by Upton on generators, and Upton's calculations for an electric lighting system. Other material includes a test machine for driving magnetos, designed by Batchelor and built by Jackson; notes by Edison on hand turning a generator; and drawings by Krusei showing the layout of pipes in one of the laboratory buildings. The label on the front cover is marked "Faradic machines No. 1" and "Electro deposition Tests." The book contains 284 numbered pages.

Blank pages not filmed: 76-77.

No 8

LIBRARY OF THE

BOARD OF PATENT CONTROL,

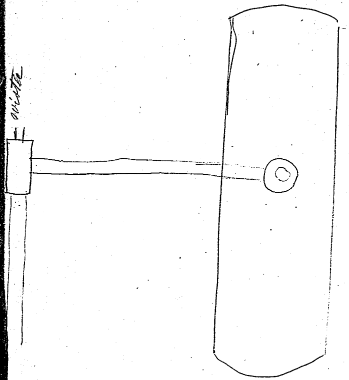
120 BROADWAY, NEW YORK.

GENERAL ELECTRIC.

............................, 189

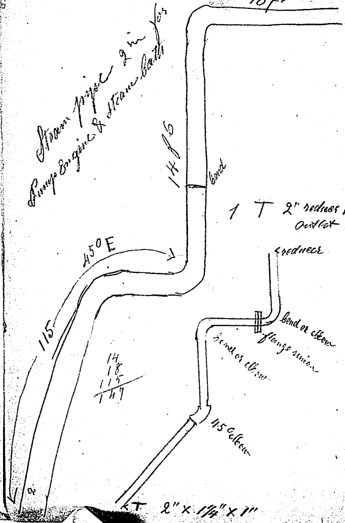
On hand 150 ft. 1"

7854
3141
7854
23562
7854
2466156
4
31416



Starting Point from Knowles pumps

Steam pipe 2 in for Pump Engine & Steam bath

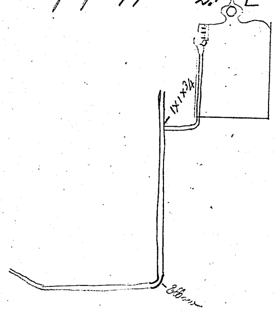


Trip pipe from exhaust & water gauges.

12 f. 3/4   1¾ Elbow

1 T 1" x 3/4.

58 f. of 1" pipe   2.1" E



6

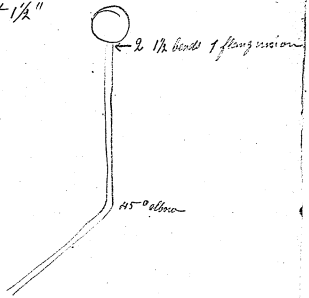
Suply pipe for cistern
all 1½ in galvanized

2 1½ bends ex. 2 coupling

2 45° Elbows

1

100 ft 1½"



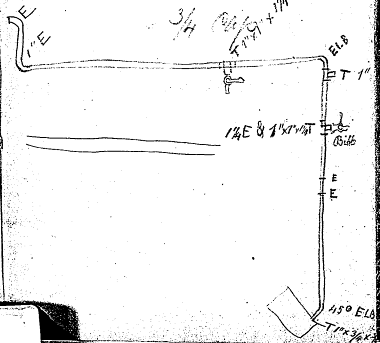
Water supply from Gallery to
& through main building

60 1 T gavanized
122 4 E 2T
1

1 45° E 1"

4 1" nipples

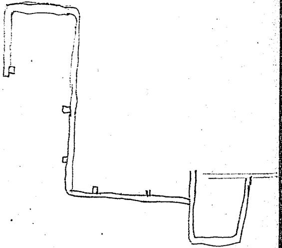
3/4 ...

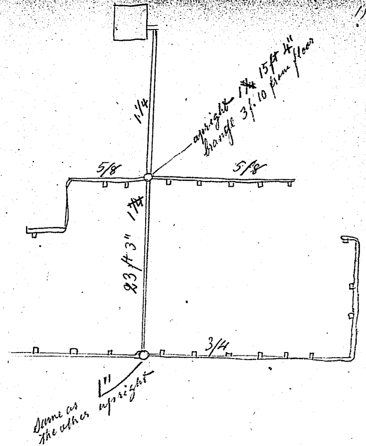


150 ft of 2 inch plain pipeing for steam under boiler pressure for S
100 ft gavanized pipe 1½
45 " " " ~~1½~~ 1 inch for small sue n. p.
100 ft of 1" plane pipe
40 " " 1¼ " "

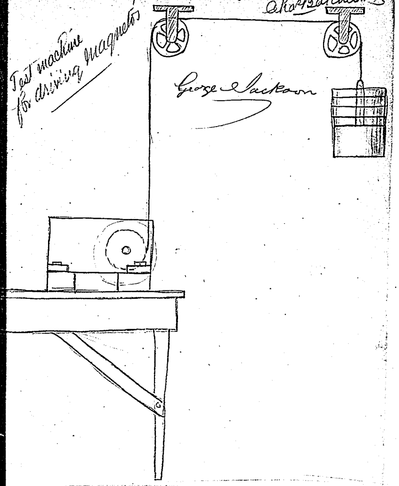
2. 2" Wrought iron bends of steam ✓
8. 2" flange unions ✓.
3. 2" shoulder nipples
1. 2" Globe valve for steam
1. T 2" = 2" × 1" " "
1. bushing ~~from 2" to~~ to reduce from 2" to 1¼
1. T 1" = 1" × 3/4
3. 1" Elbows
4. 1" nipples shoulder
4. 3/4 "
2. 1½" wrought iron Bends ✓ 4 extra 1½ coupling
1. 1½ nippels shoulder
1½ elbows ganv. 45°
1½ elbow "
1½ flange union
1" 45° elbow
bushings to reduce from 1 to 3/4
reducer from 1 to 3/4

2 reducer from 3 to ½
10. 1" Elbows
3. 3/4 wrought iron bends
1. 1½ plug
2 1" "
2 extra 1" coupling
4 " 3/4 coupling




1/4
upright ~~1¼~~ 15 ft 4"
Branch 3 ft 10 from floor
5/8
5/8
~~1¼~~
23 ft 3"
3/4
Same as the other upright 1"

Test machine for driving magnetos



George Jackson

Diameter of inside of cylinder.
5.0625 inch

~~L~~Length of Vulcanized fibre 16.29 inch
over lap about $1\frac{5}{16}$ inch

Bend first round cylinder of smaller diameter so as to have the overlap at control & rivet it up so ~~that~~. It will not quite go on the finishing cylinder then heat & put on the finishing cylinder & let cool

18

a Daniells cell over one Siemens will decompose in one second .108 Mllgr H_2O

.108 Mllgr

E.M.F. Daniells 1.17

Resis Siemens .9730

1.0493

log	.108	$\bar{1}$.0334
comp log	1.17	9.9318 — 10
log of	1.0493	0.0210
		$\bar{2}$.9862

.0969 Mllgr 1 Volt over 1 Ohm of H_2O

1 Weber

1 Farad one second

.0969 Mllgr

19

~~The~~ determination of Weber show that ~~[illegible]~~ a current having the intensity ~~of~~ of one decomposes in one second .009376 Mgr. H_2O

or .000009376 Grammes

D 11.6

18

.00092 Grammes

.00092 Grammes

~~.00092~~ Mllgr

.92 Mllgr

.092 Mllgr $\frac{1}{10}$ Daniells

Calculated from Wied.
pp 428-29.

.096 Mllgr

19

~~A Daniells cell~~

The chemical unit of E.M.F. is a force sufficient over one Siemens to decompose 1 Mllgr of H_2O

E.M.F. in ch. units of a Daniells

log .01204 $\bar{2}$.0808

2.9192

= $\frac{1}{830}$

A current which decomposes a Mllgr of H_2O in one second has an absolute (Weber's unit) 950.

There is given off

101.92 ^{10} metre-grammes of heat in one second by one Weber of current over one Ohm Latimer Clark, p. 10

.00336 Grammes of Zn burned

to give off this current,

as burned in a Daniells cell which gives in this combination 714 gm deg C per gramme

.00336	$\bar{3}.5263$
714	2.8537
425	2.6284
comp log 1.17	9.9318 − 10
	2.9402

872.

log 1019. 3.0084

101.92 ^{10} Metre Grammes Work

10192. ^{10} Centi Grammes

$101.92 \times 10^3 = 1.0192 \times 10^7$

4156×10^4	7.6186
714	2.8537
.00336	$\bar{3}.5263$
	~~7.0000~~
	7.9986

42500	4.6284
981	2.9917
	7.6101.

$4075/10^4$

.00341
714.
4

In the E. B ~~Vol. VII~~ p. 105 is given a table stating ~~of~~ the amount deposited of the various elements ~~compounds~~ by a unit of current, one Weber in one second. The table is based on the ~~so called~~ assumption ~~fact~~ that the amount of H_2O decomposed by one C.G.S. ~~Weber~~ electro magnetic unit of ~~current~~ electricity, is .00093 gramme ~~on the authority of~~ quoting as authority Weber, Joule, Bunsen, Casselman, and Kohlrausch and citing Wied. Galv. Bd. III §§ 1077–1079

25

The value of Cu on the authority of Faraday, for the equivalent, is given as ~~.00326~~ .00326. A unit of current is ~~about~~ slightly less than that given by a Daniells cell on a circuit of one Ohm. ~~Therefore~~ ~~[illegible]~~ It is this very easy to obtain a proof of ~~the numbers~~ the numbers in the table, For example Wiedemann states on the authority of Raoult that a Daniells cell on a circuit of one Siemens deposits 0.377 Mllgr ~~that is~~ ~~one [illegible] .0005~~ That is ~~if~~ Daniells having an E.M.F.

The Volt being $\frac{1}{x}$ Daniell
The [illegible] being x Ohm

	0,377	$\bar{1}$,5763
comp	1.11	9,9431 −10
comp	1,049	9,9881 −10
		$\bar{1}$,5075 −10

.321 Milligr
.000321 Grammes

of 1.14 Volts and
a Siemens being 0.973 Ohms
the amount deposited by a Weber
in one second is

$$\cancel{\frac{0.377 \times .973}{1.14 \times .[illegible]}} = \cancel{.340 \text{ Milligr}}$$
$$= \cancel{.00034 \text{ Grammes}}$$

$\bar{1}$.5763
9.9431 −10
10.0119 −10
$\bar{1}$.5313

which is about one tenth of the
quantity in the Table.
~~In referring to~~ Wiedemann
gives in the reference cited
by the Encycl. Brit. §
Bd II §1077

that a Weber's unit of current,
that is the current in a circuit of
~~1 ohm~~ $10^{10}\ \frac{\mathrm{Mm}}{\mathrm{Sec}}$
~~Leiens of~~ ~~having~~
continuously an E.M.F of
$10^{10}\ \frac{\mathrm{Mm}^{\frac{3}{2}}\ \mathrm{Mgr}^{\frac{1}{2}}}{\mathrm{Sec}^2}$, will decompose
in one second .00933 Mllgr.
1 Volt is $10^{11}\ \frac{\mathrm{Mm}^{\frac{3}{2}}\ \mathrm{Mgr}^{\frac{1}{2}}}{\mathrm{Sec}^2}$ or ten
times greater than Weber's unit,
so that it would ~~deposit~~
decompose .0933 Mllgr
in one second, or .0000933
~~Millig~~ Grammes, again one
tenth of the amount given in
the Encycl. Brit.

Kohlrausch ref. gives as
the amount of gas deposited in one

second by a Weber's unit of current as

$$\frac{1.991}{60} = .0332 \text{ Millgr.}$$

~~Wb~~ or by one ~~unit~~ Weber .332 Millg .000332 Grammes one tenth of the value given.

~~Br~~ Some results as to the E. M. F. of a Daniells are deduced in the Encyl. Brit. seemingly on the authority of Sir William Thompson pp. 84-85.

From the equation $E = J e ⊙$

$J = 4156 \times 10^4$ C G Sec

$e = .003411$ for Zinc on the authority of Kohlrauschh

$⊙ = 734$ (grm. deg. C.)

The result ~~4156×10^4~~

$$4156 \times 10^4 \times .003411 \times 734 = 1.042 \times 10^8$$

from ~~O~~ which is deduced that the E. M. F. of a Daniells is 1.042.

$1.0\ldots \times 10^8$ C. G. S. expresses the amount of heat in absolute measure ~~from~~ given off ~~by~~ from one Ohm when the total circuit is, if 1.042 expresses the E. M. F. of a Daniells 1.042 Ohms.

1 ~~Volt~~ Weber should give off on one Ohm according to this reckoning 10^8 $\frac{\text{C. G. S.}}{\text{Sec}}$ units of heat in one second. In Clark and Sabines Elec Tables and Formulae this ~~Latimer Clark gives~~ ~~the~~ amount of ~~work~~ is given as $10^3 \frac{\text{G}_s \text{M}^2}{\text{Sec}^2}$ or $10^7 \frac{\text{G } \text{C}^2}{\text{Sec}^2}$ which is again 1/10 of the figures in the article.

The error is of course repeated several times. Jenkin in his book on electricity and magnetism makes the same error and gives a table which seems to bear very little relation to the ~~equivalents~~ ~~of~~ Electrical equivalents of ~~Heat may be [illegible]~~ ~~[illegible]~~

Yours Truly
Francis R. Upton
Menlo Park N.J.
Apr. 1879.

1/2 Ohm magnet

To give an idea of the efficiancy of a Thermo as against a Calland working on 1/2 ohm resistance.

Given a thermo say of 20 elements equal in E.M.F. to one Calland cell.

If Resistance Calland = 2 Ohm
" Thermo = 2 "

Then $C = \frac{e}{R+r} = \frac{1}{\frac{1}{2}+2} = \frac{2}{5}$ in each

If Resistance Thermo = 1 Ohm

then $C = \frac{1}{\frac{1}{2}+1} = \frac{2}{3}$ $\frac{2}{3} \times \frac{5}{2} = \frac{5}{2}$

$1\frac{2}{3}$ times more current than from Calland.

If Resistance Thermo = $\frac{1}{2}$ Ohm

$C = \frac{1}{1} = 1$

$2\frac{1}{2}$ times more effective

If Resistance Thermo = $\frac{1}{4}$ Ohm

$C = \frac{1}{\frac{1}{2}+\frac{1}{4}} = \frac{4}{3}$ $\quad \frac{\cancel{4}^{2}}{3} \times \frac{5}{\cancel{2}} =$

$3\frac{1}{3}$ times more effective.

If Resistance Thermo = $\frac{1}{8}$ Ohm

$C = \frac{1}{\frac{5}{8}} = \frac{8}{5}$ $\quad \frac{\cancel{8}}{\cancel{5}} \times \frac{\cancel{5}}{\cancel{2}}$

4 times more effective.

If Resistance Thermo = 0

$C = 2 \quad 2 \times \frac{5}{2} = 5$

5 time more effective

$$\mathcal{E} = \frac{\varepsilon}{R}$$

$$W = \frac{\varepsilon^2}{R} = C\,\varepsilon$$

$$\frac{\text{Mllgr}^{\frac{3}{2}}\ \text{Mm}^{\frac{1}{2}}}{\text{Sec}^2}\ \cancel{\text{Mllgr}^{\frac{1}{2}}}\ \text{Mm}^{\frac{1}{2}}$$

$$\frac{\text{Mllgr}^2\ \text{Mm}}{\text{Sec}^2} = \cancel{A}\text{gr}\ W \quad \text{Ohrbuch}$$

$\mathfrak{R} = 10^7$ $\quad 10^4$

$= 10^{12}$ $\quad 10^7$

$= 10^{11}$ $\quad 10^{12}$

.03411 Mllgr

714

4155

10^6

$\frac{\text{Mllgr. Mhr.}}{\text{Sec}}$

$10{,}12 \times 10^{10}$

$1{,}012 \times 10^{11}$

4156 $\quad$ 3:6185 $\frac{\text{Gr C}}{\text{Sec}}$

10^4 $\quad$ 4.

734 $\quad$ 2.8657

.00341 $\quad$ 3.5328 Grammes

8.0170

.00341

.0341

2

$$\mathcal{W} = \mathcal{I}\mathcal{E}$$

$$\cancel{\mathcal{W}}\left(\mathcal{L}^{\frac{1}{2}}\mathcal{M}^{\frac{1}{2}}\right)\left(\right.$$

$$\left(\mathcal{L}^{\frac{1}{2}}\mathcal{M}^{\frac{1}{2}}\right)\left(\frac{\mathcal{L}^{\frac{3}{2}}\mathcal{M}^{\frac{1}{2}}}{\mathcal{T}^{2}}\right)$$

$\mathcal{A} = a\,z\,\mathcal{I}\,w$

$\mathcal{I}$, here is a number

~~one~~ ~~a~~w expresses the ~~...~~ w ~~a~~ ~~warmth~~ heat evolved by burning one ~~equiva~~ unit of Zn

$z\mathcal{I}$ expresses ~~one~~ the equivalent consumed

a Joules equivalent

3

$z\mathcal{I}$ z is the amount of Zn decomposed by a unit of current

$\mathcal{I}$ is the number of units of current passing

$\mathcal{I}$ is simply a numeral

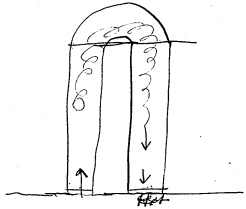
$\mathcal{I}\mathcal{E} = a\,z\,\mathcal{I}\,w$

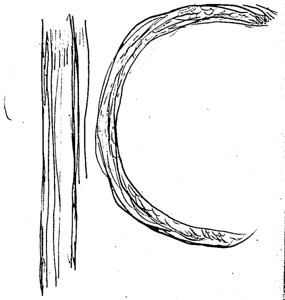
this equation is not wholly true

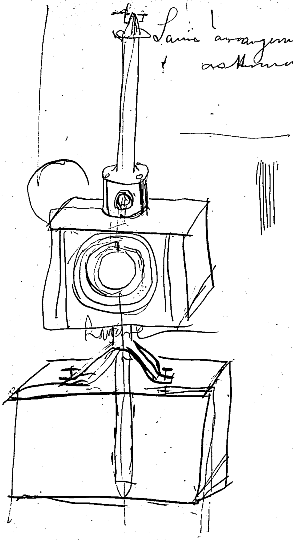
$\mathcal{I}\mathcal{E} = a\,z\,i\,w$

i a numeral

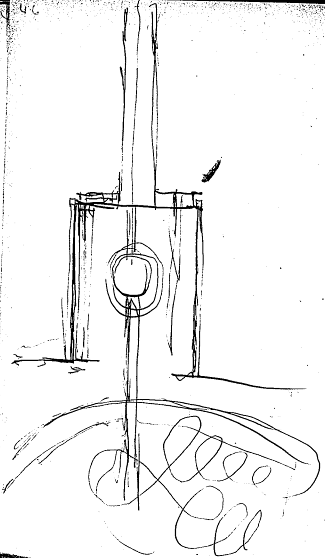
$\mathcal{I}\mathcal{E} = a\,z\,i\,w$

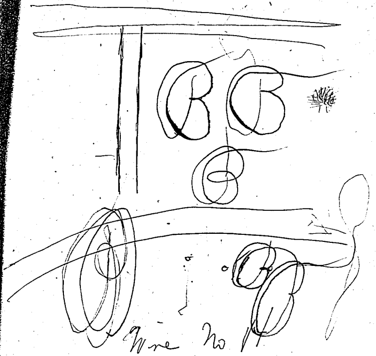






Same arrangement
as [illegible]

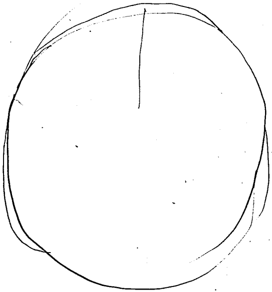




Wire No 11

Draw the Aluminum

wire to the [illegible]



31,475   10

31,415 Centim

31,415	1.4970
18.	1.2553
	2.7523

5.65 Metres

5.65	0.7523
.0375	$\bar{2}$.5740
	$\bar{1}$.3263

.212 Ohms

1 foot

50

17.72

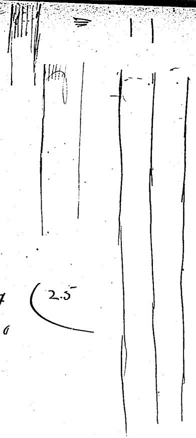
886. Ohms

1500

40

$\frac{40}{1000}$

$\frac{1}{25}$



$\frac{1}{25} = \frac{x}{64}$

$\frac{64}{25} = x$

25) 64
50
140

2.5

$\frac{2}{64}$

Daniells Buff paragraph II. 105-9. W.G.
liberates in one second through
1 Siemens
•0116 Mllgr. H

Raoult II 1060 W.G.

Daniells 1 Siemens 1 second
•377 Mllgr Cu.
•108 Mllgr water
•012 Mllgr H

1074 II W.G.
1 Ohm = 1.0493 Siemens

Kohlrausch II 1080

1 second unit of current
.11363 Mllgr Ag
.009476 Water

~~From~~ Casselman, ~~Bunsen~~
and Weber, using tan galva and
measuring horizontal intensity
of the Earths magnetism
at the same ~~time~~
.009421 Mllgr Water
Electro chemical equivalent of
~~water~~

E.M.F of Daniells
= 11.57
11.08 E.M.F. Kohlrausch
10.25 Bosscha

54

5-5

1000
10 | 100

2

1000
10

$\sqrt{10}$ $10\sqrt{10}$

$1000\sqrt{10}$

$\sqrt{10}$ $10\sqrt{10}$ 10000

$\sqrt{10}$ $1000\sqrt{10}$
$1000\sqrt{10}$

$10\sqrt{10}$
$1000\sqrt{10}$

100,000 1,000,000

$10\sqrt{10}$
$10\sqrt{10}$
1000

$$\frac{L^{\frac{3}{2}} \cdot M^{\frac{1}{2}}}{T^2}$$

1000 mm = m

$$(10\sqrt{10})^3 = 10000\sqrt{10}$$

$$10\sqrt{10} = 10\sqrt{10}$$

$10^6 \times 10^5 = 10^{11}$ 1,000,000

$$(10\sqrt{10})^3 = \frac{\sqrt{10}}{\cancel{1000\sqrt{10}}} = 10\sqrt{10}$$

Cm

$$\frac{\sqrt{10}}{10\sqrt{10}}$$

10

$$1\ \frac{10\sqrt{10}}{1000 \quad 10^3}$$

$100\sqrt{10}$

$$10^8 \times 10^3 = 10^{11}$$

$$1\ \frac{Cm^{\frac{3}{2}}\ Gr^{\frac{1}{2}}}{Sec^2} = 1000\ \frac{Mm^{\frac{3}{2}}\ mg^{\frac{1}{2}}}{Sec^2}$$

Cm = 10 mm

$$Cm^{\frac{3}{2}} = 10\sqrt{10}\ mm^{\frac{3}{2}}$$

$$Gr^{\frac{1}{2}} = 10\sqrt{10}\ mg^{\frac{1}{2}}$$

R. E.

$J = 4156 \times 10^4 \ \frac{Gr\ Cm^2}{Sec^2}$

$J = 4156 \times 10^9 \ \frac{Mg\ mm^2}{Sec^2}$ $\frac{1000}{10^3}$

1000

M. G

$J = 4156 \times 10^6 \ \frac{Mg\ mm^2}{Sec^2}$

.03411 ~~Gramme~~ Mlgr

.00003411 ~~Mlg~~ Gramme

.0003411

Weber .03411 Mlg

3.411 Gramme

.03411 Mllgr

.00003411 Gramme

.0003411 since Webers unit = 1/10 Volt

Volt deposits when on resistance of 1 Ohm

.0003411 Gramme Gr

or uses it in battery

Mm — Mm Mm

Mm

$\frac{m\,L}{T^2}\ \frac{L}{T}\ T$

Mg mm

$\frac{m^{\frac{1}{2}} L^{\frac{3}{2}}}{T^3}$

$\frac{m L^2}{T^2}$

$m^{\frac{1}{2}} L^{\frac{1}{2}}$

$\cdot\, m^{\frac{1}{2}} L^{\frac{1}{2}}$

$$E.M. = \frac{M^{\frac{1}{2}} L^{\frac{3}{2}}}{T^{2}}$$

L $\quad 10\sqrt{10}$

$\sqrt{10}$

100

10^6

10^4

.00341 Gramme

00 3.41 Mlgr

.31

.003411 Mlgr

3

.341

.03411 Mllgr

1.000

C G S

$W = (10^{-1})^2 (10^9) = 10^7$

$\left(10^{-1} \frac{L^{\frac{1}{2}} M^{\frac{1}{2}}}{T}\right)^2 \left(10^9 \frac{L}{T}\right)$

$= 10^7 \frac{L^{\frac{3}{2}} M^{\frac{1}{2}}}{T^2} = 10^7 \frac{C^{\frac{3}{2}} Gr^{\frac{1}{2}}}{Sec^2}$

$10^7 \frac{C^{\frac{3}{2}} G^{\frac{1}{2}}}{Sec^2}$ = amount of heat given off in one second by one Weber in one Ohm

10^7

1 Daniells cell deposits

Rays. Raoult

.377 Mllgr of Cu

in one second when the ~~total~~ resistance of the circuit is one Siemens unit

Daniells has E.M.F. = 1.07 Volts

Latimer Clark

Siemens unit = .973 Ohms

	.377	$\bar{1}$.5763
	.973	$\bar{1}$.9881
Comp	1.07	9.9706 − 10
		9.5350 − 10

.343 Mllgr. in one second by 1 Volt in 1 Ohm

.000343 Gramme

6 $D = 1.07$ Volts

$\bar{1}.9881$
9.9706
$9.9587-10$ constant for change from Daniells over Siemens to Volt over Ohm

Water .108 $\bar{1}.0334$

$\bar{2}.9921$

.0982 Mllgr Water per second 1 Volt over 1 Ohm

~~9.0049~~

.012 Mllgr H in one second from one Daniell

.00947 Mllgr Water decomposed by Weber's unit of current.

$$E = 10^{10} \frac{Mm^{\frac{3}{2}} Mllgr^{\frac{1}{2}}}{Sec^{2}}$$

This shows that a Weber's unit of E.M.F. is 1/10 of a Volt

.0120 Mllgr H

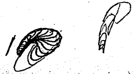
$$\frac{.012}{1.0493 \times 10^{-10}} \times 957$$

$$\frac{.012 \times 957}{1.0493 \times 10^{10}}$$

1 Ohm = 1.0493 Siemens

$10^{10} = 1.0493$ Siemens

Siement $= \cancel{\frac{1.0493}{10}} \; \frac{10^{10}}{1.0493}$



4 Ohms
outside
1 Ohm inside
4 lamps each
of one Ohm how
many Ohms can be
put in one lamp?

$W = \frac{C^2 R}{Q}$ $\frac{1}{4}$ on each lamp

$\mathcal{E} = \frac{C}{R}$

~~$W = \mathcal{E} C$~~

$W = \frac{\mathcal{E}}{R} = \frac{\mathcal{E}}{R}$

16 $\frac{\mathcal{E}}{R} = 1$ 4

16 $\frac{\mathcal{E}}{R} = 1$

16 $\frac{1}{4}$ current

$\frac{4}{16}$ $\cancel{\frac{1}{4}}$

1 Ohm in machine

$W = c^2(R+r)$

$= c^2(4+1)$ $\quad \mathcal{E} = 1$

in each lamp

$W = \frac{c^2(4+1)}{5} = \frac{\mathcal{E}}{R}$

$C = \frac{\mathcal{E}}{(R+r)} = \frac{1}{25}$

$W = \frac{1}{25}$

$W = \frac{c^2(4+1)}{5}$

$W = \frac{1}{5}$

$W = c^2 = \frac{1}{25}$

$C = \frac{\mathcal{E}}{R}$

$W = \frac{\mathcal{E}^2}{R^2} = \frac{1}{25}$

$W = \frac{1}{25}$ on each lamp

$C = \frac{\mathcal{E}}{(R+r)}$

$W = \frac{1}{25}$

$\frac{1}{25} = \frac{\left(\frac{1}{\cancel{4}+R+1}\right)}{\cancel{R}} \frac{R}{R+1}$

$= \frac{R}{(R+1)^2}$

$R^2+2R+1 = 25R$

$R^2 - 23R = -1$

$R^2 - 23R + \left(\frac{23}{2}\right)^2 = \left(\frac{23}{2}\right)^2 - 1$

$R - \frac{23}{2} = \sqrt{\left(\frac{23}{2}\right)^2 - 1}$

$R = \frac{23}{2} \pm \sqrt{\left(\frac{23}{2}\right)^2 - 1}$

$R = 15.$ Ohms

$2 \overline{)23}$

11.5

$\sqrt{10.5}$

$= 3?$

11.5

3.6

15.1

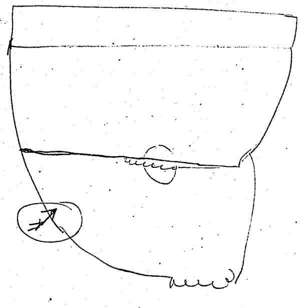
$$\text{Work} = \frac{m\,L}{T^2}\,\frac{L}{T}\,T$$

$$= \frac{m\,L^2}{T^2}$$ Weber over Ohm

$$= 10^7\,\frac{\text{Cm}^2\ \text{Gramme}}{\text{Sec}^2}$$

10^4

.001019



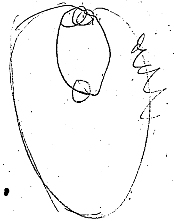
18 Ohms by the method of halfing the resistn

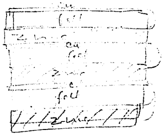
18 Ohms outside

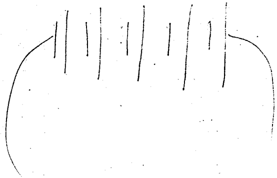
360 = D

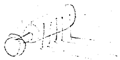
0 Ohms outside

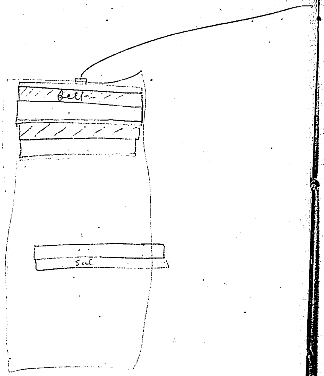
185 = D










Bell
Soil

Determination of ~~Gramme~~ Machine running 1060 Revolutions per minute

Galvanometer

A cell composed of Zn amalgamated, neutral solution of sulphate of Zn., porous cup, neutral solution of Cu, electrotype Cu.

This is the standard given by Wiedemann and its E.M.F. is about 1.09 Volts

Three cells of gravity are compared and the total deflection obtained from the four.

The galvanometer is then shunted to bring the ~~readings~~ deflection from the four at about 50 on the scale.

Then the E.M.F. from the Gramme is taken over a measured resistance. Measured when hot. From this the Current is calculated and compared with the deflection on the dynamometer.

The constant of the Dynamometer can then be calculated. It is the deflection for 1 Weber.

The square root of the sine of this is the unit division, to divide the square root of the sine of any other deflection by to obtain the number of Webers.

 The galvanometer

standard cell	200 L
No. 1	180 L
No. 2	180 L
No. 3	180 L

Total brought down to 50

60 = 4 in circuit

Fiducial 1' L

12° 10' = Dynam

22 D = D

over 1.1 Ohms

5 Ohms in Total circuit

$$\frac{220}{50} = 4.4$$

3 Gravity = 2.7 Standard

2.7 + 1. = 3.7 Standard

3.7 X 1.09 Volts 50 Ω

$\frac{3.7 \times 1.09 \times \cancel{220}^{4.4}}{\cancel{50}} =$ Volts

0.5682
0.0374
0.6435

Com 1.2491 17.7 Volts

over 1.1 ohm

17.7 1.2491
1.1 0.0414
1.2077

16.1 Webers

CR = E

16.1 X 5 = Volts in all
80.5 = Volts in all

Foot lbs

16.1	1.2077
16.1	1.2077
5.	0.6990
44.	1.6435
	4.7579

57.200 ft lbs of Elec.

Dynamometer

12° 10' 2 9.3237 − 10
8.6618 − 10
Webers 16.1 1.2068

Constant 2.4550 .0285
Book 17 p. 144 2.4249 .0266

This is too large an error ∴ I must go over the readings more times

1.5441
1.8751
3.4192

75
7
82.5

2620

Again
Standard 200
179
No. 1 181
No 2
No 3 150 avg

3.7 Daniell . 50 = D to left
3.7 X 1.09 Volts

$50\overline{)30.7}$
6.14

0.5682
0.0374
6.14 .7882
1.3938 24.7 Volts
.0719 1.18
1.3219 21.1 Webers over circuit

No current 75 D to L

D = 307 on 1.18 Ohms
Dy 21° 19' see p. 86

Total 3.8 Ohms

21.1 1.3219
3.8 .5798
79.8 Volts 1.9017

2 (9.5605
4.7802 − 5
21.1 1.3219
3.4583 − 5
2.4583 Constant Dynamo

$\frac{75}{50} = 1.5$
3.7 0.5682
1.09 0.0374
1.5 0.1761
.7817 6.05 Volts
E.M.F. when circuit opened

305 Again 1060 revs
3.95 Ohms total

19° 56'

R = 1.19 ohms

3.95 Ohms total

19° 56'   2.93323 −10
4.7661 −5
1.3219
3.4442 − 5

3.95   1.3219
.5966
1.9185

21.1

$\bar{2}$.4442   21.1 Webers
$\bar{2}$.4550   16.1
$\bar{2}$.4583   21.1 Webers
$\bar{2}$.4249

82.9 Volts
Constants

I take $\bar{2}$.4500

This being safe and probably near the truth.

Gramme 1060 revs
Again   6.1 Ohms total   89

8° 13'

total. 6.7 Ohm

8° 13'   9.1550

Probably

$\bar{2}$.4500
6.1275 −5
1.1275
.8261
1.9536

13.4 Weber
6.7 Ohms

89.8 Volts
Probably too much

The same

8° 29'

6.1 Ohms total ✓

8° 29 9.1658
4.5843 −5
$\bar{2}$.4500
6.1343
1.1343 13.6 Webers
6.1 .7853
1.9196

83.1 Volt

6° 4'
8

New Machine ω = 85 no commu—

10° 18' + 2'

8 Ohms Total

10° 20' 9.2537 −
4.6268
$\bar{2}$.4500
15.0 Webers 1.1768
8 .9031
1.0799

120 Volts

12° 12'

6.34 Ohms

(9.3267

4.6433
2.4500

1.1133   11.9

6.34   .8021

1.9154   82.3

15 weber   1.1768
1.1768
.9031
1.6435
4.9062

79000
66
13

2 1/3 H.P.   8 Ohms in circuit

1.1° 30'

~~50 Ohms~~ "
25 Ohms short
15 Ohms "
12 Ohms "
10 "
7 "
5 "

9

4 Daniell D = 50

About 50 Ohms in circuit

D = 10

$\frac{10}{50}$. $\frac{4}{5}$ × 1.09 Volts

4.	0.6021
.218	$\bar{1}$.3385
	$\bar{1}$.9406
	.2041
	$\bar{1}$.7365
50	1.6990
	1.4355

on 1.6 Ohms

.545 Webers

27.2 Volts on circuit

After bringing up magn

544 Volts

D = 20.

Circuit open 105 = D

$\frac{105}{50}$ = 2.1
4
8.4 .9243
1.09 .0374
.9617

9.75 Volts

93

About 30. Ohms in circuit before bringing up magnet

26

on 1.6 Ohms

after 41 = D

on 1.6 Ohms

$\frac{26}{50}$ =	.52	$\bar{1}$.7160
	4.	0.6021
	1.09	0.0374
		.3555
	1.6	.2041
	1.41 Webers	.1514
		1.4771
		1.6285

42.6 Volts on circuit

$\frac{1}{50}$ =	.02	$\bar{2}$.3010	
	4.	.6021	
	1.09	.0374	
		$\bar{2}$.9405	Constant
	41	1.6128	
		0.5533	
		.2641	
		.3492	
		1.4771	
		1.8263	

67.1 Volts on circuit.

Shunt 20.5 Ohms Total

76 ...
on 1.6

Fiducial 5' to right
42
47'

The 10 ohm spool well warm

76 $\bar{2}.9405$
.8808
.8212 6.63 volts
.2041
.6172 4.14 Webers.
20.5 1.3118
1.9290 84.9 Volts

47' (8.1358
4.0679
.6172
3.4507
$\bar{2}.4507$ Constant

11.2 Ohms total

195 on 1.63 ohms

4° 24' +4 4° 28'

Current sufficient to jump across the plug.

$\bar{2}.9405$
195 2.2900
1.2305
163 .2122
1.0183 10.4 Webers
11.2 1.0492
2.0675 116 Volts in circuit

(8.8914
4.4457 -5
1.0183
3.4297
$\bar{2}.4271$

10.2 Ohms Total

D = 225 or 1.67 Ohms

5° 30'

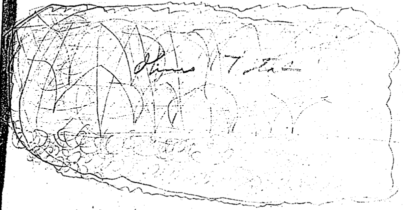
$\bar{2}.9405$
2.3522
1.2927 19.6 Volts
0.2227
" 1.0500 11.2 Webers
10.2 1.0086
2.0586 Volts
114 Volts

9.0070 − 10
4.5035 − 15
1.0500
3 45 35
$\bar{?}$.4535 constant

7.25 Ohms Total

10° 30'

9.2626
4.6313 − 5
$\bar{2}$.4500
1.1813 15.1 Webers
7.25 .8603
2.0416 111 Volts



Gramme - 1040 rev

6.74 Ohms Total

✓

5° 40'

2(8.9945

4.4972

2.4500

11.1 Webers 1.0472

674 .8287

75.9 Volts 1.8759

8° 43'

5.77 Ohms Total

9.1805 ✓

4.5902

3.4500

1.1402 13.8

5.77 .7612

1.9014

79.6 Volts

5.3 Ohms Total

11° 23'

9.2952
4.6476
$\bar{2}$.4500
1.1976 15.7 Webers
5.3 .7243
83.5 Volts 1.9219

4.95 Ohms Total

12° 42'

9.3421
1.6710
$\bar{2}$.4500
.2210 16.6 Webers
4.95 .6946
1.9256
84.3 Volts

4.25 Ohms Total

17° 54'
4.22 Ohms

9.4876
4.7438
$\bar{2}$.4500
423 1.2938 19.6 webers
.6263
83.2 Volts 1.9201

22° 9'
3.75 Ohm Total

9.5763 -10
4.7881 -5
$\bar{2}$.4500
1.3381 21.7 Webers
3.75 .5740
1.9021 79.8 Volts

Gramme 1040

25° 2'

3.5 Ohms total
3.6

25° 2'

(9.6264
4.5132
2.4000
1.3632 23.0 Webers
3.55 .5502
1.9134

81.9 Volts

1.3632
1.3632
3.5 0.5441
44.2 1.6454
4.9159

82400

Result Gramme 1040 105 revo

	Ohms	Volts	Webers	
p.100	6.74	75.9	11.1	per H.P. 8.47
p.90	6.1	83.1	13.6	5.65
p.101	5.77	79.6	13.8	
p.102	5.3	83.5	15.7	
p.102	4.95	84.3	16.6	
p.103	4.22	83.2	19.6	
p.88	3.95	82.9	21.1	
p 87	3.8	79.8	21.1	
p.103	3.75	79.8	21.7	
p.104	3.55	81.7	23	1.9
	3.5	82.7	23.6	
	2.92	79.4	27.2	
	2.32	68.7	29.6	
	5.25	64.1	12.2	
	4.4	75.8	16.2	
	2.7	59.8	22.1	
p.201	4.1	84.2	20.5	

~~New machine 840 revo.~~

~~Gramme~~

~~255~~

36° 20'

3.5 ohms total

9.6469

4.8234

2.4500

1.3724 23.6 Weber

3.5 .5441

1.9175

Volts

82.7

36°

2.92 ohms total

2 (9.7692

4.8846

2.4500

1.4346 27.2 Webers

2.92 .4654

1.9000 79.4 Volts

44° 10'

2.32 ohms 1.4715

9.8430

4.9215

2.4500

1.4715 29.6 Webers

2.32 .3655

1.8370 68.7 Volts

~~84.9~~00 Volts

New Faradic Gramme on Field

2° 57

15.35 Ohm

(8,7115

4.3557 - 5

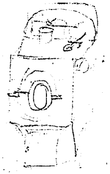
$\bar{2}$,4506

0.9057 8,05 Weber

15.35 1.1860

2.0917

123 Volts



Gramme Machine.

The next to the Largest Shoulder
To determine its constant

Standard cell	200
Daniells extremely well separation	193
No. 2	193
No. 3	193
	2)779
~~4~~ cells 50 = D	3.89

4° 41′

91 = D

over .73 Ohm

3.89
1.09

4.23 Volts

.5899
.0374
.6273

50)9.1

1.82 .2601
4.23 .6273
Comp .73 10.1367
1.0341

10.5 Webers

2)8.91.19
4.4559 −5
10.5 1.0341
3.4318
$\bar{2}$.4318

15° 48' No resolution

183 = D over

18° 30' 1/2 Ohm coil

196 204 annotating

19° 30'

207

19°.40' about 80

5.0)204

4.08

4.08 .6273

.80 .6107

10.6969

1.3349 21.6 Webers

1.46

2)9.5126

4.7563

1.3349

3 4214

$\bar{2}$.4214

14° 55'

225 = D

R = .99 Ohms

.6273

5.0)225 .6532

4.5 .99 10.0044

1.2849

19.2 Webers

9.4106

4.7053

19.2 1.2840

3.4204

$\bar{2}$.4204

$\bar{2}$.4318

$\bar{2}$.4214

$\bar{2}$.4204

say $\bar{2}$.4250

10° 39'

4.22 Ohms

42

18° 10'

3.13 Ohms

$20^\circ 45' = \mathcal{D}$

2.55 ohm

$23^\circ 16'$

2.15

$22^\circ 16'$

$C = c' + c'' = \frac{1}{R'} + \frac{1}{R''} = \frac{1}{R}$

$\frac{R' + R''}{R'R''} = R$

$R = \frac{R'R''}{R' + R''}$

~~$R' = 1$~~ $c' + c'' = 1$

~~$R'' = 10$~~

.11

$\frac{10}{101}$ $\frac{1}{\frac{101}{10}} = \frac{10}{101}$

120

why I know not

21° 30′ 1060 revs Belt slipped badly

1.7 Ohms Total

1.3570
1.3570
.3304
.6454
3.5908

9.5640
4.7820
2.4250
6.3570
6.3570

1.3570 22.7 Webers

1.7 .3300
1.6874

48.6 Volts

Belt slipped

The dynamometer did not do well think it is placed so that the earths magnetism affects it ... ~~the north~~ Perhaps the engine was running slow

121

why I know not

25° 40′

1.55 Ohms

1.3933
1.3933

2) 9.6366
4.8183

~~1.55~~ 2.4250
1.3933 24.7 Webers

This does not agree in the least with results previously obtained

4.8183
2.3771
1.[illegible] 27.6 Webers
1.4412

1.55 .1903
44. 1.6435
4.6962

49,600 ft. lbs

Do not understand will investigate

Day 20

1.4771
1.4771
.1903
1.6435
4.7880

61,300 ft. lbs.

150 L

19°
.53 Ohm

4,23
3
12.69 1,1035
.53 $\bar{1}$.7243
1,3792
23.9 Webers

19°

(9.5126
4.7563
1,3792
3.3771
$\bar{2}$.3771

log 3 ohms total
1,3792
1,3792
3 .4771
.6454

~~2 6 40~~

152 = D on .53 Ohm
19°.38'
2.8 ohm Total

.53 ohms

19°.38' 1,3792
9,5263
4,7631
1,3792
3.3939
$\bar{2}$,3939

2.8 1,3792
44 1,3792
0'4472
1.6435
4.8491

70.600

70.600 ft. lbs.

next page

4 Daniells April 10

50 L

4.9 R

---

4 lamps p. 137 .80 Ohm

4

3 circuits 3)3.20

1.06 Ohm

1/2 machine 70600 ft. lbs.

35300 4.5478

.12 1.0792

3.4686

2940 1.1761

15 candles 2.2925

196 ft. lbs. per candle

15 candles to lamp

175 = D

on .95 Ohm

10° 17'

3.65 Total

---

50)175 60

3.5 .5441 500

4.23 .6263

ank .95 10.0.223

1.1927

15.5 Webers

10° 17'

L 9.2516

4.6758

1.1927

~~.8685~~

3.4331

$\bar{2}$.4331

195 = N

11° 57' .92 Ohms

50 / 195
3.9

/ 195
3.9

3.9 .5911
4.23 .6263
comp .92 .0362
18. Webers 1.2536

2 / 9.3160
4.6580
1.2536
3.4044
$\bar{2}$.4044

109 = N

2° 5' 1.23 Ohms

50 / 109
2.18
4.23
comp 1.23

.3385
.6263
9.9101 − 10
.8749

7.5 Webers

2° 5'

/ 8.5605
4.2802
.8749
3.4053
$\bar{2}$.4053

180 = D

5° 20'   1.24 Ohm

50/180

3.6   .5563

4.23   .6263

Comp 1.24   9.9066

1.0892

12.2 Webers

8.9682

~~1.0892~~

4.4841

1.0892

.3949

$\bar{2}$.3949

210 = D   1.27 Ohm

10° 5'

50(210

4.

4.2   .6332

4.23   .6263

Comp 1.27   .8962   .10

1.155

1.1557   14.3 Webers

9.2432

4.6216

1.1557

1.4659

$\bar{1}$.4659 Constant

13° 35'

1215 = D   or .91 Ohms

4.3   .6335

.6263

Comp 10.0410

20 weber   1.3008   2.9.3708

4.6864

1.3006

33856

$\bar{2}$.3856

McG.

On lamp

$4^0\ 40'$

$5^0\ 18'$

4.2 Ohms

D.

πD

.88

1,67
88
.79 Ohm

D = 230 R

230

even 1,67

~~60~~) ~~230~~
4.6
4.23

1,67
11,4

.6628
.6263
1.2891
.2227
1.0664

1,0664
1,0664
7.3976
1.6035
3.6739

,79
44

4720

33,000 4.5185
3.6739
.8446

6,9 Lamps per H. P.

114 = D

.93 Ohm

210 = D

2.14
2.28

2.28
4.23
Comp. .9310

.4440
.6263
.315
1.1018

1.69
.93
.76

3579

50)200
4.2
4.23

.6232
.6263
1.2495
1.69 .2279
1.0216
1.0216
1.0216
.76 . 1.8808
44 . 1.6435
3.5695

3700

3700

4.5185
3.5675
.9510

9 per - P

120

4° 40°

120 = D over .95 Ohm

1.58
.95
.63 Ohms

200 = D

4.23
4
16.92

1.2279
.1987
1.0292
1.0292
1.7993
63
44 1.6435
3.5012

3100

155
155 = D
155

4° 57'

1.2 ohms

250 = D

1.91
1.55
.46 ohms

5 (155
3.1

3.1 .4914
523 .6263
comp 1.2 9.9208 - 10
1.0385

10.9 webers

4° 57 2 (8.9359
4.4679
1.0385
3.4294
$\bar{2}$ 4294

The zero point had changed

Tried to determine the amount H.P. used the resistance of the lamp being determined by substitution Mly as the field of the magneto did not make in the same way.

3° 30' Quite fair determination

.75 Ohm

2 (8.7856
4.3978 - 5
$\bar{2}$.4000
.9978

9.95 Webers

.9978
.9978
.75 $\bar{1}$.8751
44.2 1.6454
3.5161

3.280
3200 4.5185
3.5161
1.0624

10. Per H.P.

unbrite

Lamp bright yellow

.77 Ohm

4° 2'

(8.8471
4.4235
$\bar{2}$.4000
1.0235
1.0235
.77 $\bar{1}$.8865
44.2 1.6454
3.5789

3800.

4.5185
3.5789
.9396

11.5 webers

8.7 per H.P.

This is somewhat too small as I did not deduct enough for my leading wires

May 10 new machine

on 3rd case from end

1185 revolutions.

Standard Daniells 200

no 1 196

$\cancel{3}$.88

200

4 | 7/8/8 | 197

200 | 7.88

3.94 Daniells

3.94 .5955

1.09 .0374

.6329

4.29 Volts

50 = D for 4 Daniells

72 = D

2° 27'

on .76 Ohm dischange

50/72

1.24

4.29

.0934

.6325

comp .76 10.1192

.8451

7.0 Webers

8.6309

4.5154

.9457

3.4703

$\bar{2}$.4703

~~138 = D~~
~~.92 Ohms~~
~~3° 47'~~ NG.

175
1.10 Ohms
6° 33'
8.2 Ohms total

50 / 1.75
3.5 .5441
4.29 .6325
comp 1.10 9.9586
13.5 Webers 1.1352

Constant 2.3933

9.0571
4.5285
1.1352
33933

~~D75~~ (X)

~~May 9~~ P.M.
50 = D 4 Daniells

179
1.08 Ohms
6° 22'

50 / 179
3.58 .5539
4.29 .6325
comp 1.08 9.9666 −10
14.2 Webers 1.1530

9.0449
4.3224
1.1530
33694
2.3694

180

1,12

6° 12'

50 (180

3.6

4.29 / 1.12

.5563

.6325

9.9508

1.1396

13.7

2 (9.0334

4.5167

1.1396

3.3771

2.3771

206

1,15

~~60 15~~

210

1 ohm coil smoking

8° 46'

1,14 Ohms

50 (210

4.2

4.29

.6232

.6325

9.9431 - 10

15.8 Webers

1.1988

2 (9.1830

4.5915

1.1988

3.3927

2.3927

2° 26.   106 = 40

2° 20'

1.1 Ohm

50 / 104
2.08   .3181
4.29   .6325
comp 1.1   9.9586
             0.9092

6.1 Webers   0   32.63
             .9092   31.81
                       182

/8.6397
4.2048
.9092
3.4056
2.4056
182
2.3974

50/106   .3263
2.12   .6325
             9.9586
             8

284
264

1.16 Ohms   13° 4'

50(264
5.28   .7226
             .6325
comp 1.16   .9355   /9.3542
19.5   1.2906   4.6771
                           1.2906
                           3.3865
                           2.3865

264

1.16 Ohms   13° 4'

1.13

170 = D

5° 49' .164

5.0 / 17.0

3.4

4.29 .5315

.6325

comp 1.13 .9464

1.1109

12.9 weber

(9.0058

4.5029

1.1109

3.4920

2.4920

Total 12.75

2° = D

(8.5428

4.2714

3.4040

8.6754

12.75 1.1053

4.9761

7.43 Webers

94 Volts on 12.75 Total

There is a constant of 4° to the left from the current

228 £ − 4

1.14 Ohms

10° 36′

50(224
4.44
4.29

and 1.14

.6474
.6325
9.9431
1.2230

9.2647
4.6323
1.2230
3.3993
2.3993
1.126
2.4867

16.7 Webers

5/228
456

3577
6590
6474
126

16.7 Webers

85 £

1.10 Ohms

~~1° 3′~~ 1° 37′

50(81.
1.62

.2095
.6325
1.10 9.9556
.8006 6.32 Webers

6

1°37

2(84504
4.2252
.8006
3.4246
2.4246

.164

i.1

6° 54'

8.5 Ohms total

50/164
3.28   .5159
4.29   .6325
colog 1.1. 9.9547 -10
12.6   1.1031   Webers
8.6   .9345
9.0796   1.0376
4.5398   109 Volts
1.1031
3.4367
$\bar{2}$.4367

Results

	Webers	
4° 41'	10.5	$\bar{2}$.4318
19° 40'	21.6	$\bar{2}$.4214
14° 55	19.2	$\bar{2}$.4204
19°	23.9	$\bar{2}$.3771
19° 38	28.0	$\bar{2}$.3939
10° 17'	15.5	$\bar{2}$.4331
11° 57'	18	$\bar{2}$.4644
2° 5'	7.5	$\bar{2}$.4053
5° 20	12.2	$\bar{2}$.3949
10° 51	20.	$\bar{2}$.3856
6° 33'	13.5	$\bar{2}$.3933
6° 22	14.2	$\bar{2}$.3674
6° 12	13.7	$\bar{2}$.3771
8° 46'	15.8	$\bar{2}$.3927
2° 20.	8.1	$\bar{2}$.3974
13° 4	19.5	$\bar{2}$.3766
5° 49'	12.9	$\bar{2}$.4920
Calculated 2°	7.43	$\bar{2}$.3993
10° 36'	16.9	$\bar{2}$.4246
1° 37'	6.3	
6° 54'	12.6	$\bar{2}$.4367

What is the trouble?

~~Drill change~~

The wire in dynamometer cannot make so great variations.

The galvanometer ~~&~~ seems to be reliable, and I know the principle is correct.

The measurements of the resistances are nearly right as they agree within 1% of each other

must find out

Perhaps I have not taken care enough

12/96

	Webers	
1° 37	6.3	$\bar{2}.4246$
2° 5'	7.5	$\bar{2}.4053$
2° 20	8.1	$\bar{2}.3974$
4° 4	10.5	$\bar{2}.4318$
5° 20'	12.2	$\bar{2}.3949$
5° 49'	12.9	$\bar{2}.4920$
6° 12'	13.7	$\bar{2}.3771$
6° 22'	14.2	$\bar{2}.3694$
6° 33'	13.5	$\bar{2}.3949$
6° 54	12.6	$\bar{2}.4367$
8° 44'	15.0	$\bar{2}.3627$
10° 17	15.5	$\bar{2}.4351$
10° 36'	16.7	$\bar{2}.3993$
11° 57	18.7	$\bar{2}.4044$
13° 4	19.5	[illegible]
14° 55	19.2	[illegible]
19°	23.9	[illegible]
19° 30	24.9	[illegible]
19° 45'	21.6 ~~At~~	[illegible]

May 10

Standard	200 L
No. 1	194 L
No. 2	195 L
No. 3	198 L

No. 2	195 R
No. 3	198 L

Made No 3	100 L
No 2	100 R

Both together 204 to the right

No 2	100 L
Nos 2 & 3	200 L
	201

Fixed the galvanometer so that the scale was at right angles to the ray at zero. Placed it slightly further away leveled it carefully

No. 2	100 L
3	100 R
Nos 2 3	201 L
Standard	102
No. 1	100
Standard No. 1	202

Current gave 16 to left when galvanometer

2 | 197

394

3.94 .5955
1.09 .0374
.6329

4.29 Volts

4 Daniells

D = 50

D = 2R ~~when~~ from current

335 L   50/33.5
6.7

11° 4'

1.14 Ohms
5
1.09
4.29 — .6329
6.7 — .8261
~~.6374~~
9.9626 -10
1.4216

26.4

2 | 19.2831
4.6415
1.4216
3.2199
$\bar{2}$.2199

41   .05 in connecting wire

16'   1.08 Ohms

1.08
5
1.03

50/41
.82
4.29

$\bar{1}$.9138
.6329
9.9666
.5133

3.27 Webers

16'

17.6678
3.8339
.5133
3.3206
$\bar{2}$.3206

118 ℒ
2
116

1.15 ohms
5
1.10

1° 37′

50) 116
2.32
4.29
amp 1.15

.3655
.6325
9.9393 − 10
.9373

8.65

2) 8.4504
4.2252
0.9373
3.2879
2̄.2879

2̄.2879

136
.2
134

2̄.28 1.08
5
1.03

2° 14′

50) 134
2.68 0.4281
4.29 0.6325
amp 1.03 9.9872
11.1 Webers 1.0478
8.5907
4.2850
1.0478
3.2382
2̄.2382

1.14 ~~.9569~~

134

2° 14′

107
5
1.02

10) 775 (77..
70
75
70
5

175
170
1

1.08 ohms 1.03
10.6 Total
3° 21.

175
775
875
1225
1225
135625
16
813750
135625
2170000

May 11 P.M

4 Daniells 50

$165 = D - 4 = 161$ $\frac{5)161}{3.22}$

3° 14'

1,07 Ohms

.5
1.02

3.22 .5079
4.29 .6325
amp 1.02 9.9914 -10
1.1318

13.5 webers

$2)8.7513$
4.3756
1.1318
3.2438
$\bar{2}.2438$

$222 = D - 4 = 218$

$221 = D$ 1,40 Ohms

~~225~~

$\frac{5}{135}$

$5)\overline{278}$
4.36

3° 14'

4.36 .6395
4.29 .6325
amp 1.33 9.8697 -10
1.1417

$2)8.7513$
4.3756
1.1417
3.2339

$\frac{1}{150}$ $\frac{1\ 775}{155}$

251 = D

244
4
240

$3^\circ\ 14'$

1.57 Ohms
5
1.52

50 | 240
4.8
4.29
comp 1.512

.6812
.6325
9.8182 -10
1.1319

13.5 Webers

260

$3^\circ\ 33'$

1.57 Ohms

260
4
50 | 256
5.12
4.29
comp 1.57

.7093
.6325
9.8041
1.1459

2 | 8.7918
4.3959
1.1459
3 2 5 0 0
2.2 5 0 0

.50 for 4 Daniells

100
.96
.96
98

$1.49 - 4 = 145 = D$

1.20 Ohms

3° 38'

50 (145
2.9 0.4624
4.29 0.6325
comp. 1.15 9.9393
10.8 Webers 1.0342

(8,8058
4.4029
1.0342
33787
$\bar{2}.3787$

$1.18 = D - 4 = 1.14$

1.20 Ohms .05 = 1.15

2° 14'

50 (114
2.28 .3579
4.29 6325
1.15 9.9393
8.5 Webers .9297

(8.5907
4.2953
.9297
$\bar{1}$.3656 constant

166

148 -4 144

1.21 Ohms -5 1.16

3° 31'

50 (14.4

2.88 .4594

4.29 .6325

Comp 1.16 9.9355 -10

1.0274

10.6 Webers

2 (8.7877

4.3938 very good

1.0274

3.3664

167

D = 200 - 4 194

6° 22'

1.27 Ohms -5 1.25

50 (194

3.88 .5888

4.29 .6325

Comp 1.25 9.9031

13.3 1.1244

(9.0449

4.5224

1.1244

3.3980

2.3980

168

240 = ∅ − 4   236

8° 36′

1.28 ohms −.05 1.23

50 / 236

	4.72	.6739
	4.29	.6325
Comp	1.23	9.9101 − 10
		1.2165

16.4 Webers

2 / 9.1747

4.5873
1.2165
3.3708
2.3708

169

175 = ∅ − 4   171

8° 39′

.95 ohms − 5   90

50 / 171

	3.42	.5340
	4.29	.6325
Comp	.90	10.0458 − 10
		1.2123

16.3 Webers

175 27
775
87635
122689
122689
145834
167
1020838
875004
145834
2435427

170 215 − 4 211

12° 45′

.96 Ohm

.91

5.0) 21.1

.4.22

4.29

Comp .91

.6753

.6325

10.0410 −10

1.2988

19.9

9.3438

4.6719

13689 4.13621 .2988

5.9 0.77093 .3831

3.36532 .3831

2317.

5.0090

1.6435

2370

3.3655

17

5.9 Total

13° 12′

2) 9.3586

4.6793

~~3.3800~~

1.2993

19.9

5.9 .7709

2.0702

117 Volts

2.0702

.0374

107 Damells

2.0328

117 2.0682

117 2.0682

Comp 5.9 9.2291 − 10

44. 1.6435

102000 5.0090

4.5185

3.09 H.P. .4905

10.1 Ohms Totals

3° 28'

8,7815

4,3907
2,3800
1,0107

10, weber
1,0107
10.1 1,0043
2,0150

103 Volts

103 2.0128
103 2.0128
comp 10,1 8.9957
44. 1.6435
4.6648

No 1 Plate
94.925

No. 2 92.155

172

No. 3 irregular

69.6.47

No. 4.

98.688

May 14 1879 8-45 am 173

Standard Daniells

i = 200 L

No 1 cell 195 L
No. 2 cell 196 L
No 3 cell 200 R
No 3 cell 200 L
No 2 cell 199 R
No. 1. cell 195 L
Standard 203 R
Standard 200 L
204 R

cell $\frac{98}{100}$ R Standard

4 cells 50 L

$$\begin{array}{r} 98 \\ 4 \\ \hline 392 \\ 1.09 \end{array}$$

$$\begin{array}{r} 9.5933 \\ .0374 \\ \hline .6307 \end{array}$$

4.27 Volts.

Edison faradic machine

The coils connected in threes: magnet quantitized

1160 revolutions

D = 146 R

over .92 Ohm

6°

.92 - 5 = 87

Current 4° D to right

146
4
50 / 142
2.84
4.27
Comp .87

.4533
.6307
10.0605 - 10
1.1445

13.95 Webers

2 / 9.0192
4.5096
1.1445
3.3651
$\bar{2}$.3651

170 R = D

7° 36'

over .95
5
.90

170
4
50 / 164
3.28
4.27
Comp .90

.5159
.6304
10.0458 - 10
1.1921

15.5 Webers

9.1214
4.5607
1.1921
3.3686
$\bar{2}$.3686

.183 = D over 1.28 Ohms

4° 53 .05
1.23

183
4
50 (179
3.58
4.27
comp 1.23
12.7 webers

.5539
.6307
9.9201
1.1047

8.9300
4.4650
1.1047
3.3603
$\bar{2}$.3603

144 = D

9° 19' .75
5
.70

~~2.83 Ohms Total~~

Constant $\bar{2}$ 3675

2 / 9.2092 - 10
4.6046 - 5
$\bar{2}$.3675
17.2 Weber 1.2371

144
4
(140
2.8
4.27
comp .70
17.08

.4472
.6307
10.1549 - 10
1.2328

4.6046
1.2328
3.3718
$\bar{2}$.3718

7° 57′

2.03 Ohms Total

Constant $\bar{2}.3617$.

	9.1408	
	4.5704	
	$\bar{2}$ 3675	
15.9 Webers	1.2029	
2.03	.3075	
	1.5104	32.4 Volts
1.09	.0374	
	1.4730	29.7 Daniells

4° 36′

2.38 Ohms Total

	8.9041	
	4.4525	
	$\bar{2}$.3675	
	1.0850	12.1 Webers
2.38	0.3765	
	1.4616	28.9 volts
	.0374	
	1.4242	26.6 Daniells

12° 28'

1.78 Ohms

2) 9.3342

4.6671
$\bar{2}$.3675
1.2996 — 19.9 Webers
1.781 — 0.2504
1.5500 — 35.4 Volts
.0374
1.5126 — 32.4 Daniells

May 1880 note Magnets 24 in. by 4 in.
45 coils 3 layers 3 turns No. 18 wire
.056
Armature 6" diameter see plans
6" long
See Book 16
Magnets No. 13 wire .095 in
864 Turns Batch

4° 5'

4° 16' 2.53 Ohms

8.8612
4.4306
$\bar{2}$.3675
1.0631 — 11.5 Webers
2.53 — .3979
1.4610 — 28.9 Volts
.0374
1.423 — 26.5

9 wires 15" coils
Magnets quantitied
2.03) 32.4 (16 Webers
8 Webers each magnet
8 X 864 = 6672 strength
6672

1.2 Ohms

31° 28'

(9.7176

4.8558

$\bar{2}$.3675

1.4913 — 3.1 Weber

1.2 — .0792

1.5705 — 37.2 Volts

.0374

1.5331 — 34.1 Daniells

---

540 revolutions

4° 6'

over 1.10

(8.8542

[illegible]

$\bar{2}$.[illegible]

1.0[illegible] — 11.4

1.1 — .044

1.1010 — 12.6 Volts

.0374

1.0736 — 11.8 Daniells

6° .98 Total

9.0092 - 10
4.5046 - 5
$\bar{2}$.3675
1.1371 13.7 Weber
.98 $\bar{1}$.9912
1.1283 13.4 Volts

1.1371
1.1283
1.6464
3.9118 8.160 ft lbs
$\frac{1}{4}$ H.P

1° 22' 1.51 Ohms

8.3775
4.1887
$\bar{2}$.3675
.8212 6.62 Weber
1.51 .1790
1.0002 10 Volts

8212
10002
1.8214
1.6464
3.4678 [illegible] ft lbs
$\frac{1}{10}$ H.P

Speed faster 800 revolutions

5° 16' 1.54 Ohms

18.9628
4.4814
$\bar{2}$.3675
1.1139 13. Webers
1.54 .1875
1.3014 20. Volts
.0374
1.2640 18.3 Daniells

1.1139
1.3014
1.6464
4.0617 11.550

$\frac{1}{3}$ H.P.

18° 58'

1.01 Ohms

19.5119
4.7559
$\bar{2}$.3675
1.3884 24.4 Webers
1.01 .0043
1.3927 24.7 [illegible]
.0374
1.3553 [illegible]

1.3884
1.3884
.[illegible]
1.[illegible]
4.[illegible]75 25.7[illegible]

1° 56′

2.04 Ohms

8.5281
4.2641
$\bar{2}$.3675
.8966 7.88
2.04 .3096
1.2062 16. Volts
.0374
1.1688 14.7

.8966
.8966
.3096
44.3 1.6464
− 3.7492 5.610 ft lbs
+ 4.5185
.7693 $\frac{1}{5.8}$ H. P

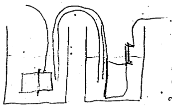
19° 27′

1.02 Ohms

9.5224
4.7612
$\bar{2}$.3675
1.02 1.3937 24.7 Webers
.0088
1.4025 25.2 Volts
.0374
1.3651 23.2 [illegible]

1.3937
1.3437
.0088
4.6464
4.4424 27000

Monday June 9 1879



Standard Daniells

Zn well amalgamated
Concentrated solution Zn Sulphate
Con. " $CuSO_4$
Cu Tube containing acid
~~Water~~ H_2O before the
water was acidulated
its resistance was so great
as to affect the galvanometer
over 1/3.

Resistance in line about
~~7~~ 55.000 Ohms

D = 230 Standard
~~No D~~ 4 = 215 No. 1
227 No. 2
200 No. 3 circuit just
200 opened.

D = 237 R Standard
235 R
233 R

Standard 40
No 1 ~~do~~ 70

4 cells. 200

215
227
200
235
877

877
235

2.9430
.13711
.5717
.0374
.6093

3.73 Daniells
1.09
4.07 Volts

Fiducial. 5° 31' R
5° 28'

Gramme 265.0
over .96 Ohm

1° 38' R

2.65	.4232
Volts 4.07	.6096
comp .96	19.0177 −10
	1.0505

11.2 Webers

5° 30'
1 38'
3° 52'

~~8.8288~~
2 | 8.8288
4.4144
1.0505
3.3639
5
$\bar{2}$.3639 Constant.

D = 335.0
over 1 Ohm

1° 20 R

Total cold
5.4 Ohm

3.35	.5250
4.07	.6097
	1.1347

13.6 Webers

5° 30
1° 20'
6° 50

2 | 9.0754
4.5377
1.1347
3.4030
5
$\bar{2}$.4030 = Constant.

13.6	1.1347
5.4	.7324
	1.8671
73.6 Volts	1.1347
	3.0018
44.5	1.6484
44,600. foot lbs	3.6502

1002

 June 9. P. M.

No. 1 200

No 2 200

No 3 200

Standard 205

Made the four = 50

$C_1 = \sqrt{\sin^2 D_1}$ $\qquad C_1^2 =$

$C_2 = \sqrt{\sin^2 D_2}$

$\frac{C_2}{C_1} = \frac{\sqrt{\sin^2 D_2}}{\sqrt{\sin^2 D_1}}$ $\qquad \sin D_1 = C_1^2$ $\qquad \sin D_2 = C_2^2$

$\frac{C_2}{C_1} = \frac{\sqrt{\sin D_2}}{\sqrt{\sin^2 D_1}}$ $\qquad \frac{C_2}{C_1} = \frac{\sqrt{\sin D_2}}{\sqrt{\sin D_1}}$

$C_1 = \frac{\sqrt{\sin D_1}}{\sqrt{\sin D_2}} C_2$

$C_1 = \sqrt{\sin D_1}$ / Weber

$C_1 = \frac{\sqrt{\sin D_2}}{C_2}$

~~sin C_1 =~~

$\frac{C_1}{C_2} = \frac{\sqrt{\sin D_1}}{\sqrt{\sin D_2}}$

$\frac{C_1}{\sqrt{\sin D_1}} = \frac{C_2}{\sqrt{\sin D_2}}$

$\frac{C_3}{\sqrt{\sin D_3}} = \frac{C_1}{\sqrt{\sin D_1}}$

$C_3 = \frac{\cancel{C_1}}{\sqrt{\sin D_1}} \sqrt{\sin D_3} = \frac{\sqrt{\sin D_3}}{\sqrt{\sin D_1}}$

$\sqrt{\sin D_1} = \frac{\sqrt{\sin D_3}}{C_3}$

205) 805 (4 $\qquad$ 805 / 20 #

805 $\quad$ .9058
205 $\quad$ .3118
$\quad$ .5940
3.92 Dam .0374
4.28 $\quad$ .6314

Fiducial 5° 23'

D = 150
= 145 12' R

over .96 Ohm

50/148
2.96 .4713
4.28 .6314
comp .96 .0177
1.1204 13.2 Webers

5° 23'
12
5° 11

Suppose 4.4779 - 5
$\bar{2}$.3373
13.8 webers 1.1406

2/8.9558 - 10
4/4779 - 5
1.1204
$\bar{1}$.3575 - 0 Constant

.4713
.6314
.91 .0410
1.1437 13.9 Webers

4.4779
1.1437
$\bar{2}$.3342 Constant

D = 55 over .95
4° 43'

50/55
1.1 .0414
4.28 .6318
.95 .0223
.6955 4.96 Webers

5° 23
4° 43
40'

2/8.0657
4.0328
.6955
$\bar{2}$.3373 Constant

.0414
.6318
comp. .90 .0458
.7190 5.24 Webers

4.0328
.7190
$\bar{2}$.3138 constant

D = 208 over 1.32 Ohms

5' R

50/208
4.16 .6191
4.28 .6314
Comp 1.32 9.8794 -10
1.1299

13.5 Webers

5° 23'
5'
5° 18'

2/8.9655
4.4827
1.1299
$\bar{2}$.3528 Constant

.6191
.6314
1.27 9.8962 -10
1.1477

14.05

4.4827
1.1477
$\bar{2}$.3350 Constant

D = 240 over 1 Ohm

7° L Total 4.1

50/240
4.8
4.28

.5812
.6314
1.3126
4.1 .6128
1.9254

20.5 Webers
84.2 Volts

7°
5° 23'
12° 23'

2/9.3313
4.6656
1.3126
$\bar{2}$.3530

~~Add~~ Substract .05 for resistance leading wires

.5812
.6314
.95 .0223
Total 3.96 1.3349
.5977
1.9326

21.6 Webers
85.6 Volts

4.6656
1.3349
$\bar{2}$.3307 Constant

3° 28' Fiducial

.56 Ohm in lamp

2° 58'

3° 38' Fiducial

Wires .047 Ohm to be taken from all measurements
Connecting wires in lamp .0250 Ohm

.01

.035 total to be taken from lamp

.035
.047
.082

.56
.082
.458 in lamp

5° 38
2 58
2° 40

10 Webers

8.6676
4.3338 - 5
2.3300
1.0038

100 — .458

44.5

2040

2.
1.5609
1.6609
1.6484
3.3093

33000

4.5185
3.3093
1.2092

16.1 per H.P.

204 Page 137

suppose 10 Weber
and .7 Ohm in lamps

	2 1.8451	
44.5	1.6484	4.5185
3910	3.4935	3.4935
		1.0250
		10.57 H.P.

Instead of 8.7 per H.P. which shows the need of accuracy.

Gramme 1040 revs with brass 205

70 to L no current.

4 Daniell = 5

120 to L ver. .65 − .05 = .60
115

5° 2'

1.15 L

~~8.0~~ 110 L .64 - 5 =. 5 - 90...

4° 30

4° 23' 6.3 Ohm Total

L110

June 10

Standard 200

200

No. 3 195

No. 2 205 205

No. 1 200 ...

208 June 10 P.M.

~~#835~~ 4 Daniells . 50

268 revs.

New machine slowest speed driven by Gramme

3° 22' Current on dynam

105 D on Galvanometer

95 over 1.65 Ohms

Total 9.1 Ohms

New Machine Gramme on magnets 1.09 209

30/105. June 10 268 revs 47

436

2.1 .3222

4.36 .6395

comp 1.65 9.7825 -10

.7442 5.55 Weber

9.1 .7442

5.55 .9590

.7032 50.5 Volts

3° 22' 2/8.7688

4.2844

3.3300

1.0544 11.2 Weber

on magnet

Suppose constant 3.3500

1.0344 10.8 Webers

June 10

Same 11.2 Webers from Gramme Magnets

100 R on new machine

over 1.34 Ohms

Total resistance = 7.7

4.36
2
8.72 .9405
Comp. 1.34 9.8961 10
.8166 6.55
7.7 .8865
1.7031 50.4 Volts

.8166
.8166
.8865
44.5 1.6484
41681 14.700 foot lbs.

total from New machine

Current on magnet 10 5'6'

June 10

New machine

95 R over 1.32

Total 7.3 Ohms

8.5241
4.2620
2.3300
.9320 8.55 Webers

95
1.9
4.36 .2788
.6215
Comp. 1.32 9.8494 10
.7977 6.26 Webers
7.3 .8633
1.6610 45.7 Volts

.9320
.9320
1.6484
3.5124

3255 foot lbs on magnet

June 10.

11.2 : 8.55 :: 50.4 : 38.5

50.4	1.7031
8.55	.9320
amps 11.2	8.9508
	1.5859

If the E.M.F falls proportionally to the current of the magnet it should have been 38.5 instead of 45.7 Volts.

~~If it fell as the square~~

If the square of the E.M.F. fell

$11.2 : 8.55 :: 50.4^2 : x^2$

This is quite near see pp. 229-35[?]

June 10

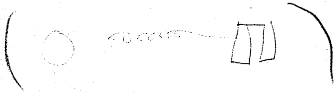
1.7031
1.7031
.9320
8.9508

$2 \overline{)3.2890}$

1.6445

instead of 45.7

44.5 E.M.F.



11.2	[illegible]
11.2	[illegible]
44.5	[illegible]
5450	3.7368

[illegible]

Magnet [illegible]

New machine [illegible] new

Drum [?] 1027

214 Wednesday June 11. 1879.

No. 1 Daniell 220
No. 2 220
210 L
220 L

No 1 215 L
Standard 215 L
225 R

4 cells 50 $\frac{107}{428}$

shall take Daniells as 1.07 Volts as the Standard was the same as the other cells

June 11 215

New machine speed 268 revs on its own field

Very slow in coming up

190 L over 1.67

2° 47' consider the leading wires as about equalling the loss by delay in measuring

50 / 190
3.8
4.28
Comp 1.67

2° 47

.5798
.6314
9.7773
.9885 9.74 Webers

2) 8.6862
4.3431
9885
3.3546

185 1.68

2° 26'

6.20 after 2 minutes
6.25 on account of discharge of magnet

probably 6.3

50 | 1.85
3.7
4.28 .5682
.6314
comp 1.68 9.7747 - 10
.9743 9.42 Webers

2° 26' | 8.6279
4.3139
9743
$\bar{2}$.3396

9.42 .9743
6.3 .7993
1.7736 59.3 Volts

I do not understand how this is! for yesterday having the Gramme machine on the field giving a current of 11.2 Webers the Edison only gave an E.M.F of 50.4 Volts!

See page 223 where reading today shows an E.M.F of 60.5 there being 8.26 Webers on field.

Yesterday's reading perhaps wrong
The speeds were the same by measurement

155 Ω over 136 − .045

= 1.315

1.32

2° 55′

After one minute 1.34

Two 1.33

6.35 Ohm one minute after half

$$\frac{155}{50}$$

3.1

4.28

Comp 1.32

.4914

.6314

9.8794 − 10

1.3026

10.05 [illegible]

2° 55

(8.7065

4.3532

1.0026

$\bar{2}$.3506

63,5 Volts

Perhaps having the ~~armature~~ magnet in circuit may increase this E.M.F. acting as a reservoir to bridge over small variations. Not so.

Ex. Put the armature through the magnet and test its E.M.F. [illegible] also without magnet in circuit.

No dif.

Found that the Dynamometer must be shaken as it [illegible] clogged & [illegible] movement. Dust the reason for this on the surface of the Hg.

150 R   over 1.33 - 4.5

1.29

2° 53'.

6:3 about seven minutes after stopping machine

.50/150 = 3.0

4.28
3
12.84
1.3

Comp

1.1072
9.8861
.9933   9.15

9.85 Webers

2° 53

18.7015
4.3507
.9933
2.3574

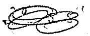
9.85   .9933
6.3   .7993
1.7926

62 Volts

H Gramme machine

1040 revo. Large magnet in circuit

180R



The dust on the Hg. on the Dynamometer seemed to cling to the points and dampen very strongly the vibration the ~~[illegible]~~ points were moved forcing them. [illegible] dust

 June 11

Gramme

182 R over 1.35 —

3° 48 Total 6.45

.50/182

	3.64	.5611
	4.28	.6314
Comp	1.35	9.8697
		1.0622

11.5

6.45	.8096
11.5	1.0622
	1.8718

74.4 Volts

3° 48 (8.8213

4.4106

1.0622

2.3474 Constant

June 11 P.M.

Gramme of field 2° 56'

Total 5.32

50/170 R over 1.32 - 05

1.28

	3.4	.5315
	4.28	.6314
Comp	1.28	9.8928 -10
		1.0557

11.3 Webers

5.32	.7259
	1.7816

60.5 Volts

On field

1° 56' (8.5243

4.2621

2.3450

.9171

8.26 Webers

Revolutions 268 per minute

None lost by belt slipping

Gramme 3'

Total 5,4 Ohms

150 R over 1.34 Ohms

1.29

8.7188

4.3594

$\bar{2}$.3450

1.0144 10,3 Webers

180 2,2553 New Machine

52 1.7160

.5393

3.46 .6314

4.28

Comp 1.34 9.8729

1.0436 11,0 Weber

5,4 .7324

1.7760 59.7 Volts

Short circuiting brought up the field in from 135 R ~~190 R~~ to 140 R

When Gramme taken off 15 R over 1.28 Ohm

First 20 then in about a minute 15 and two minutes 10 R

Opened the circuit so that the galvanometer formed part of the circuit 51 to the right from the permanent magnetism

4.2 Volts

A sounder placed in the circuit gave break. Mr. E. found that it was due to lack of pressure on the commutators.

June 11 P.M.

New Machine ~~Gramme on field~~

.87' 50' 5.35 Ohms Total

Gramme on field

160 on

1.32 ~~Kilo Totally~~

~~5.85~~ ~~[illegible]~~

~~New Machine~~

50 2 | 8.1626

4.0813

$\bar{2}$.3450

.7363

5.35 .7284

1.4647

5.45 Webers

29.1 Volts

Gramme 160 $\times$2

2.2041

1.7161

.4881

428

Comp 1 3

June 11 P.M.

Gramme on Galv

186 to left

New on Dynamometer

Gramme on Galvanometer

175.27

775

87635

122689

122689

135834~~25~~

167

950838

~~815004~~

815004

135834

226,84278

300 | 2,268,427

7561

7561

2268427

2,275,988

184700

2,460,688

2,451,162

9.526

2266 2259 700

221 Gramme June 11 P.M. New Machine Dynamometer

~~1 ...~~	
175 L	2° 14'
130 L	1° 49'
35 L	23'
280 L	2° 46'

Total Ohms Taper

4 Daniells 526 R
52 L

Perhaps the constant of Dynamometer has changed as I cleaned the Hg.

June 11 P.M. Gramme 229

52)175(3.36
156
190
156
340

3.36
4.28
1.27 Conf.

.5263
.6314
9.8894
1.0471

.5208

11.1 Weber

2° 14

18.5499
4.2749
2.3450
.9299
.7993
~~1.136~~
1.7292

6.3

8.51 Webers

~~54.~~ Volts
53.6

---

30)130(2.46
104
240
208
320

2.46

.3909
.5208
.9117

Gramme

8.15 Weber

1.49'

18.5010
4.2505
2.3450
.9055
.7292
1.6327

6.3

8.04

42 Volts

23'

7.8254
3.9127
$\bar{2}$.3450
.2577

Grammes

1.82 Webers

52)350(.67
312
380
364
160

7.8261
.5208
.3469
.7000
1.0469

2.22 Webers

11.2 Volts

52)280(5.57
260
200
260
400

.7459
.5208
1.2667

18.4 Webers

2° 46'

4.3418
$\bar{2}$.3300
1.0118
.7292
1.7410

10.2

55.1 Volts

1.6836
4.3418
$\bar{2}$.3450
.9968
.7292
1.7260

9.9 Webers

53.2 Volts

11.1 : 8.15 :: 8.51 : ~~8.4~~ x

62.7

.9117
9.9299
8.9529 -10
8.7945

x^2

.9117
.9299
.9299
8.9529
1.7444
.8722

555

7.45 — x^{2}

8.15 : 1.82 : 8.04 : x

9.0883-10
.2577
.9055
.2515

1.78

9.0883-10
.2577
.9055
.9055
2)1.2570
.6285

425

 June 11. 1879 P.M.

As the magnet is nearly saturated the ~~E.M.F. of steps~~ square of the E.M.F are proportional to the strength of the current around the magnet see p. 212. The law for this to be thoroughly tested

June 11 P.M.

New Standard cell

Thoroughly amalgamated Zn In solution ( ) Zn. a siphon used to connect this with a saturated solution of $CuSO_4$ having a Cu. plate in it.

D = 200 L D = 205 R

another cell the same only having a porous cup in place of siphon to separate the fluids

D = 206 L D = 210 R

The resistance of the first must be very great as there are about 60 ohms in the line and its E.M.F is also [illegible] the same, for when the two are connected opposing a deflection of 5 to left is obtained

 June 11

showing that the cell with porous cup has the greater E. M. F. D=5

2.5 % greater   Zn in Porous No. 1
                 " " Siphon No. 2

Now why?

Took the solutions and Zn. from the cell with siphon and put in porous cell 200 L. 205 R.

Changed Zn.
205 L   206 R
205 L

O
O
205 L
206 R

Changed to Zn from Siphon
205 L
206 R

In the siphon cell No. 1 Zn.
203 R
200 L

allowed a little cu to leak over into the zn cell no change

Against each other 2 L
1 R

~~Constant deflection~~ R made O

Against each other O
1 R
2 L

Siphon 200 R
Porous 205 R
Siphon 202 L
Porous 205 L

No. 3 185 L
No. 2 202 L

No. 2 and Siphon
6 L

Siphon 200 L
No 3 200 L

Side by side 200

Siphon 202 R
No. 2 202 R

Siphon about 4 R stronger

0

Siphon 201 R
Porous 205 R

against each other 0 "exact"

~~Siphon 200 L~~

Porous 205 L
Siphon 200 L

against each other 0 "exact

The siphon has a very large
resistance and at first ~~an~~
had ~~a~~ fluids of different density
in it. Also some unknown distur-
bance perhaps moisture on wire
&c. Better use the porous cups
as being more exact

porous and No. 3 20 R
23 L

porous 20 stronger

porous 205 R 205 L
No. 3 180 R

 June 11 singly

The difference of E. M. F
is greater than the difference
~~B~~ a when placed against each
other

Internal resistance
of Siphon battery 1200 Ohms

June 12 1879

Standard 200 R & L forward
No. 3 185 ~~[illegible]~~
No. 2 197
No. 1 190 L 192 R
Standard 200 L

No 1 192 R
No. 4 as new cell fluids badly
mixed 170 right
No. 2 193 L
190 L
No. 1 190 L
No 3 new 192 L
Standard sum

Newly arm[illegible] June 12 a.M

No. 1 192 L 192 R

No. 2 190 L 192 R

No 3 193 L 192 R

Stand 200 L 200 R

New machine

D = 210 on 1.62 Ohm

4° 26' 5.7 ohms total

1210
4.2
4.23
Comp 1.62
11.0 Weber

.6232
.6263
9.7905
1.0400

June 12 a.m

192
192
192
200
2nd 1776
3.88

388
109
3492
388
42292

268 revs

4° 26'

8.8881
4.4440
1.0400
3.4040 Constant

5.7
11
57
57
62.7 Volts

June 12 a.m.

$D = 214$ 1.33 Ohms

268 revs −.4 = 1.29

7° 25′ 4.7 total ?

50 / 214

4.28 .6314

4.23 .6263

comp 1.3 9.8861 − 10

1.1438 13.9 Webers

7° 25 19.1108

4.5554

1.1438

$\bar{3}$.4116 = Constant

4.7? .6721

13.9 1.1438

1.8159 65.4 Volts?

June 12 a.m.

Tried the resistance coils to see how long ~~it took~~ they required in cooling

5168 revs

15 sec	136
20 "	135
20 "	134
20 -	137
20 sec	132
1 min	131

Test time required in cooling

268 revs

30 134

25 133

25 132

about every 20 sec. .01 Ohm to be added to the resistance of the

140
139
138
137. 30
136 15
135 20
134 20
133 25
132 45
131

268 revs

195 L

after 50 secon 135 + 3.5

Total 5.05

6°

50)195

3.9 .5911
4.23 .6232
1.33 9.8761 - 10
5.5 1.0904 12.3 Webers
6° .7033
1.7937 62.1 Volts
19.0192 probably 64 Volts
4.5096 as two minutes expired before measuring
1.0904
2.4192. Constant

 June 12 ~~A~~ 1.25 P.M.

268 revs ~~4 cells~~ 4 Daniells gave 46 L
45 R

Perhaps this was so this morning
and altered all my results
and made the Constant of the
Dynamometer higher than before

~~4 cells~~ Standard 200 L
195 R

No 3 190 R
Fiducial changed 5 L

Again
Standard 196 L
198 R 196

No. 3 194 R 192
no. 2 191 R 189 L
no. 1 191 R 189 L
766

.8842
.2923
.5919 3.91 Daniells
.0374
1.09 .6293 4.26

4 Daniells June 12 50 L —
268 revs 50 R +

New machine on its own
field

200 over 1.34 ohm
3/10 sec.
5° 49' 1.33
5° 45'

4 .6021
426 .6293
amps 1.33 9.8761
1.1075 12.8

5° 49' .90058
.45070
1.1075
3.4954 Constant

268 rev 182 L over 1,34 Ohms

4° 44'

50 | 182

3.64 .5611

4.26 .6294

comp 1.33 9.8761

1,0666 11.5

4° 44 8,9165

4.4582

1.0666

2.3916

258 rev Field brought up

145 L 1.32

3° 4' 145' / 2,9

Not brought up 143

2° 59'

2.9 .4624

4.26 .6294

comp 1.32 9.8794

.9716 9.37

2° 59 8.7163

4.3581

.9716

.3865

268 revs

117 over 1.32

2°

(117

2.34	.3692
4.26	.6294
1.3	9.8861
	.8847

7.67

(8.5428
4.2714
.8847
2.3867

103 L

268 revs

8.2 ohms

1° 37′

Took out five Ohms and put back

93 L

1° 19′

(103

2.06	3139
4.26	6294
1.3	9.8861
	.8294

6.75 Webers

(8.6504
4.3252
8294
.3958

8.3

.8294
.9191
1.7485
56 Volts

14. L   50 / 14

.121

.28
4.26
1.3

.91 Weber

$\bar{1}.4472$
$\bar{1}.6294$
9.8861
$\bar{1}.9627$

7.5429
3.7714
$\bar{1}.9627$
$\bar{1}.8087$

250 R.   1.37

268 ~~000~~

$9^\circ\ 14'$

Total 3.95 Ohms.

5
4.26
1.37

.6990
.6294
9.8633
.1917
3.95   .5966
1.7883

15.5

61.4

9.2053
4.6026
1.1917
$\bar{2}.4109$

254

198 268 vibo

5.1 Total

5° 38'

5 | 198
3.96
4.26
comp. 1.35

.5977
.6294
9.8677
1.0968

12.5 Watts

5° 38

8.9919
4.4959
1.0968
2.3991

5.1 1.0968
.7076
1.8044

63.7 Volts

268 vibo 150

6.14 Total

3° 30'

3
4.26
comp 1.33

.4771
.6294
.8761
.9826
6.14 .7882
1.7708

9.61

59 Volts

3° 30

2 | 8.7656
4.3928
.9826
2.4102

255

254 4 Daniells 50 L
51 R
268 revs
153
6.1 Total
3° 22'

153° / 50
3.06
4.26
1.33 Comp

.4857
.6294
9.8761
.9912
.5055
.98 Weber

3° 22
8.7688
4.3844
.9912
$\bar{1}$.3932

.9912
.7853
1.7765
2.1
59.7 Volts

268 revs 124
254
2° 3'
7.1

124 / 50
2.48

.3945
.5055
.9000
7.94

2° 3
8.5535
4.2767
.9000
$\bar{2}$.3767

.9000
.8513
1.7513
7.1
56.4 Volts

4.2767
$\bar{2}$.4000
.8767
Suppose
7.53

258 Gramme on field

268 revs 2° 30' on 3.32 Ohms

Total 24.6 Ohms

98 L

(8.6396
4.3198
$\bar{2}$.4000
.9199 8.3 Webers

(.98
1.96 .2923
4.26 .6294
comp 3.32 9.4989 .1283
.4106 2.57 Webers
24.6 .3909
.8015 63.3 Volts

---

263 revs ~~50 L on 3.32 Ohms~~ 259

2° 14' No change in Gramme except from heating

50 L 3.32

Total 45.3 Ohms

.1283 . .128 Weber
.6561
45.3 .7844 60.9

2° 14' 2 (8.5907
4.2953
$\bar{2}$.4000
.8953 7.86 Webers

260

269 mu 6° 30' Gramme

55 L an New Machine

9.0538

4.5269

2.4000

1.1269 13.3

268 mu 9° 7' 261

58

9.1998

4.5999

2.4000

1.1999 15.8 [illegible]

262 June 12 15° Gramme

268 revs

60 New machine

15°

(9.4130

4.7065
$\bar{2}$.4000
1.3065 20.2

June 12 48 = .4 Daniells 263
52 first speed 268 revs
70 400
100 500
137 731 rev
169 1010
210 1380
on 3.3

Gramme 3°,1

Total 46.3

(8.7212

4.3606
$\bar{2}$.4000
.9666 9.26 Webers on field

June 12

Comp	48	8.3198 −10
	42.3	.6263
Comp	3.3	9.4815 −10
		$\bar{2}$.4276
268 revs.	52	1.7160
	1.36 Webers	.1336
	46.3	1.6646
	64.1 Volts	1.8072

		$\bar{2}$.4276
340 revs. ~~344~~		1.6646
		0 0922
	70	.8451
	86.6 Volts	.9373

520 revs	123. Volts	2.0922

		.0922
731 revs.	137	2.1367
	169 Volts	2.2289

June 12

1010 revolutions		.0922
	169	2.12279
	210 Volts	2.3211
	192 Daniells	.0374
		2.2837

1380 revs		.0922
	210	2.3222
	260 Volts	2.4144

I take for granted that the resistance of the whole circuit increases proportionally to the resistance around the galvanometer which must be nearly the case.

 June 12

4 Daniells 50

The machine on the pulley marked 500 only ran 320 5 Ohms total

belt slipped so no measurement

50 / 16.5 over 1.29

3.3	.5185	Total 6.2
4.23	.6332	
Comp 1.29	9.8894	
	1.0411	11. Webers
6.2	.7924	
	1.8335	68.1 Volts
	1.0411	
44.5	1.6484	12
33,300 ft. lbs.	4.5230	

~~423 revs~~

Belt probably slipped

220 423 revs

215 over 1.3

6.3 Ohms Total

50 / 215

4.3	.6335	
4.23	.6[illegible]	
Comp 1.27	.8962	
	1.1560	14.3
6.3	.7993	
	1.9553	90.2 Volts
	1.[illegible]	
44.5	1.6484	
	4.7597	
57,500 ft. lbs.		

~~at~~ June 12

255 on 1.32

6.35 Total

5/255

5.1	.7076
4.23	.6263
Comp 1.29	9.8894
	1.2233
6.35	.8028
	2.0261
	1.2233
44.5	1.6484
	4.8978

16.7 Webers

106: Volts

75

33.000 179.000 ft. lbs.

4.8978
4.5185
0.3793

2.4 H.P.

Jumps the three breaks in the switch

500 revolutions June 12

240

1.33

6.35

 June 12

Page 137 Lamp .77 on Gramme

75	1.8751
105	1.0212
	.8539
7.14	1.8865
.77	.9674
9.2 8 lamps	.9674
	1.9348

E.M.F. for 100 Ohm lamps.

$E_1^2 : E_2^2 :: R_1 : R_2$

$E_1^2 : E_2^2 :: R_1^{1} : R_2^{2}$

$E_1 = 75$ 75

$E_2 = x$

$R_1 = .77$

$R_2 = 100$

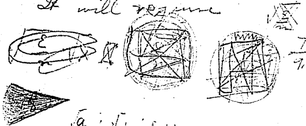
1.8751
1.8751
~~2~~
~~.1135~~
.1135
~~6.1021~~
5.8537
2.

June 12 ~~8 lamps~~ Resistance of machine = 0 271

n lamps each having a Ohms resistance require an E.M.F. of E how large an ~~resistance~~ E.M.F. will [illegible] lamps of b Ohms require in circuit

$\frac{E}{n}$ = E.M.F on one lamp of a resistance

It will ~~require~~



75 / 9.28

$a : \sqrt{b} :: E : x$

$a : b :: E^2 : x^2$

a = .77

3.9289
~~1.8644~~ 75.2
1.9644

1.8751
1.8751
2.
.1135
3.8637
.9674
4.8963
.9674
3.9289

June 12

$a : b :: \varepsilon^2 : x^2$

$a = .77$
$b = 100$
$\varepsilon = \frac{75}{9.28}$

10.1135 − 10
2.
1.8751
1.8751
9.0325 − 10
9.0325 − 10

.2 / 3.9287
1.9643

~~#~~ Volts

92,1 Volts

June 13

Standard 213 L
210 L 213 R

Zn. and Cu. solutions full saturated

No. 3 199 L 203 R

No. 2 193 L 195
193 L 194 L
195 R

No. 7 207 L
210 R

Test of Gramme regulator
having 30 ohm resistance.
1 cell Daniells 100 R

$\frac{13}{100}$ or .33 Ohm

on regulator
135

 1 cell Fuller June 13

$\frac{22}{100}$ on .66

125 on regulator

2 cells
250 255 on regulator
35
30 on .66 Ohms

19 on .33 Ohms

11 L .66
25 L

Fiducial 4 R

June 13
Standard 99 L
99 R

2 cells
on .33 Ohms
15 R

On Regulator 270 very fast

on .66 Ohms 29 & 30

on Regulator
255 R

1 cell
.33 10 R

135 L

2

.66
U = 20

June 13

Regulator 12.5

$\frac{15}{99} \times 1.09 \times 44.5 \times 3$

3	
133.5	2.1253
1.09	.0374
15	1.1761
Comp 99	8.0044
	1.3432
22.0 ft lbs 270	2.4314
15	8.8239
406 ft. lbs	2.6085
	4.5185
	2.6085
81 per H.P.	1.9100

255
1.09
Comp 99
44.5
Comp .66

June 13 .4065

On .33 Ohms E.M.F

$\frac{15}{99} \times \frac{1}{.33} \times 1.09$

15	1.1761
1.09	0.0374
Comp 99	8.0044 − 10
Comp .33	10.4815 − 10
.5 Webers	$\bar{1}$.6994
	$\bar{1}$.6990
	$\bar{1}$.5185

1.1761	
8.0044	
$\bar{1}$.1805	$\bar{2}$.9073
	44.5 1.6485
.15 Volt	0.5558

3.59 ft lbs
on .33

0.5558 June 13

270 2.4314

comp 15 8.8239

1.8111

64.7 ft. lbs.

4.5185

1.8111

2.7074

510 per H. P.

33000

33000

.66

Regulator stopped

51

Regulator running 30

Regulator running 255

Regulator stopped ~~180~~ ~~255~~

190

June 13

$\frac{190}{51}$ X .66

2.2788

1.8195

8.2924

.3907

2.46 Ohms

0 Wheatstone 3.2 Ohms

Varies a good deal

Say 3 Ohms

1.6994

1.6994

3 .4771

44.5 1.6435

1.5294

33.8 ft lbs in the resistance

64.7

33.8

30.9 ft lbs in motion

June 13

33,000 4.5185

~~30.9~~ 30.9 1.4900

3.0285

1067 per H. P.

$\frac{29}{99} \times 1.09 \times \frac{1}{.66}$ = Webers

1.4624
8.0044 − 10
.0374
10.1805 − 10
9.6851   4.84 Webers
7.6851
.66 7.8995
.445 1.6484
.8381   6.89 ft lbs

.8381 June 13

255 2.4065
com 29 8.5376 − 10
1.7822

80.5 foot lbs used

---

1 Weber current over a 100 Ohm [illegible]

---

say 30 ft lbs [illegible] tance [illegible]

$1^2 \times x \times 44.5 = 30$ ft lbs.

$x = \frac{30}{44.5}$ = about [illegible]

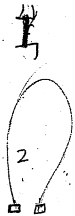
so a 3/4 of an Ohm regulation ought to do the business

Since 3 Ohm regulation [illegible] 1/2 Weber current

Hand turning a .14 machine
large fly wheel, wood
pulley –

6660 ft lbs. outside.

.4 33.



22
13
66
22
5000.
1000

9000

13.
6
19.

25
13
75
25
325

18,

9

284

1 2 3 4 5 6 7 9
4 9 3 8 2 4 1 5

10

$\frac{20}{80}$ $\frac{1}{4}$

$\frac{20}{80}$ $\frac{1}{4}$

4

1
2
3
4
5
6
7
8
9

43
43
129
172
1849
44
7396
7396
81,356

12/ 81,356

15/ 81356 (5423
75
63
60
35
30
56
45
11

10.
25
100.
60.

10
30
50

Menlo Park Notebook #9 [N-78-12-15.1]

This notebook covers the period December 1878-March 1879. All of the entries are by Edison, Charles Batchelor, and Francis Upton, with the exception of a few drawings by John Kruesi. The name of John Ott occasionally appears as a witness. Most of the material relates to experiments on electric lighting. There are drawings of lamps, including vacuum experiments; drawings of devices for making and testing wire spiral filaments; notes on platinum and platinum-iridium wire; notes and drawings of generators; calculations of system costs, including comparisons to gas lighting costs; and drawings and calculations about meters, including some labeled "Sprague's Exhibit Edison's Early Sketch No. [2-4] Jan. 12th 1886." There are also drawings of the electric pen and the phonograph. The book contains 241 numbered pages followed by 30 unnumbered pages.

No 9

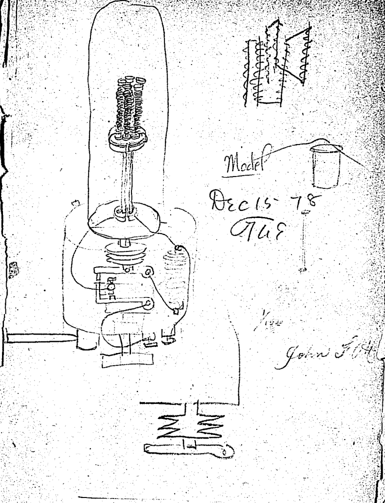
Edison Laboratory Note Book No. 9

Page 1

See Edison Patents:

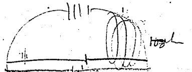
214,636	227,227
214,637	227,228
218,866	227,229

May 1, 1896.

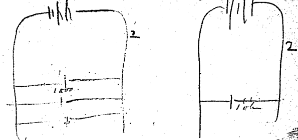


Pages 2 to 14. "Dyn[illegible] Sketches & Notes".
(Unimportant)

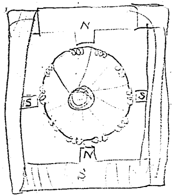
Dynamo mac. Dec 15/78
TAE



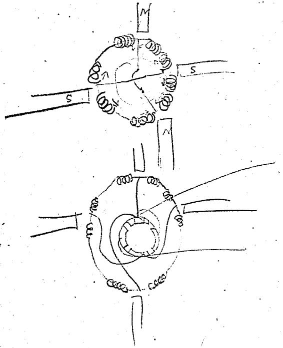
100: of 1 ohm each. 100 ohm



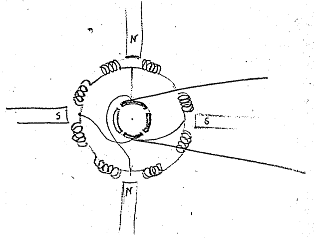
Dynamo Mac Dec 15 78
30 TAE



Dynamo Mach Dec 15/78
TAE



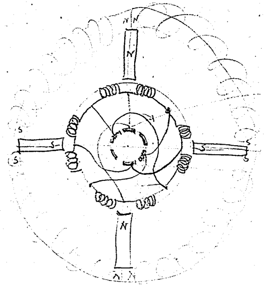
Dynamo Mach Dec 15/78
TAE

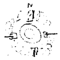


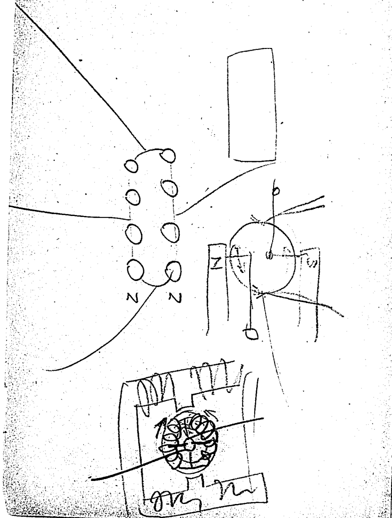
Dynamo Mac

Dec 15/78

TAE



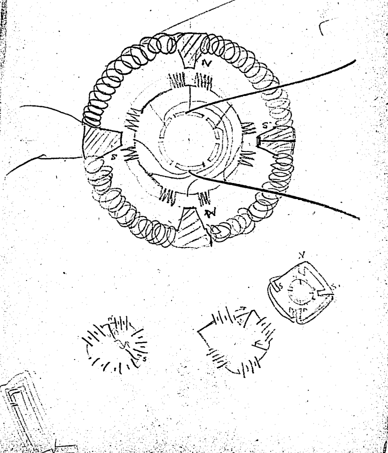




Dec 15 1878

Dynamo Mac

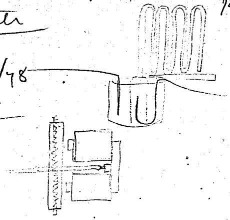
TAE



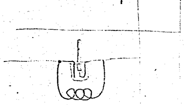
"Sprague's Exhibit Edison's early sketch, No 2"
Jan. 12th 1886

Meter

Dec 15/78
TAE



I propose to shunt a small quantity of the current through a decomposing cell of Hg or Cu & weight the deposit every month to determine



the current consumed — I could use the gas evolved by electrolysis but deposit is better as there is no polarization

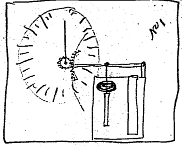
TAE

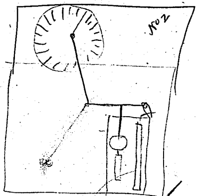
Sprague's Exhibit Edison's early sketch No. 3" Jan 12, 1886.

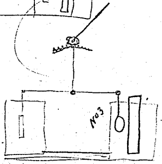
Dec 15 /78

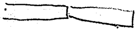
TAE

Meter.



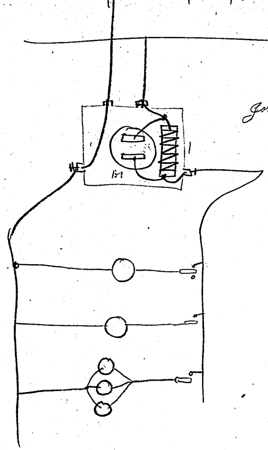




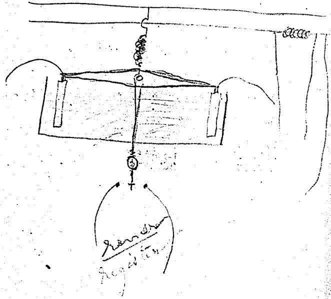


Spragues Exhibit Edison.

early sketch No 4.



John F Ott



Edison Laboratory Note Book No. 9

Page 21

Notes on Platinum & other metals & Metallic Oxides

See Edison Patents:

214,636	224,329
227,228	218,866
227,227	227,229

20

N... Laboratory Note Book No. ...

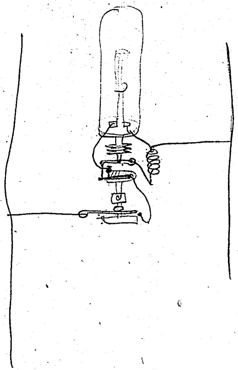
Page 21

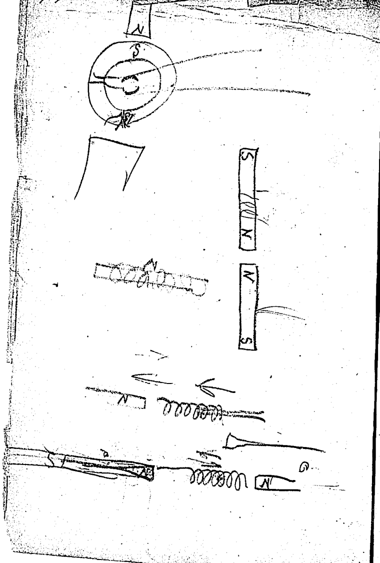
Notes on Plating ...

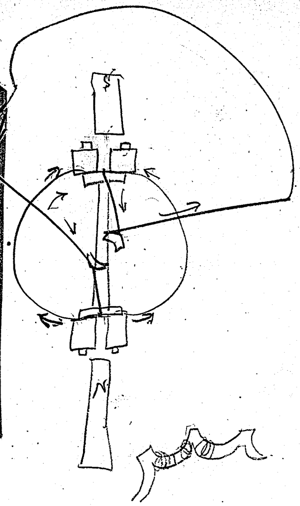
See Edison Patents:

211,050	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

21




N
S
S
N
N
S
N
N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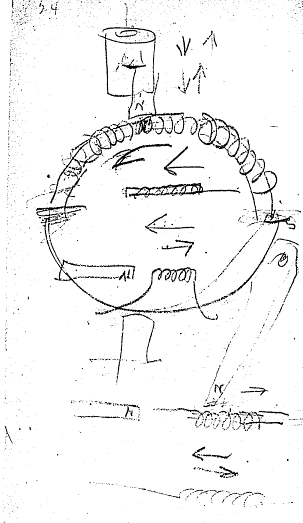
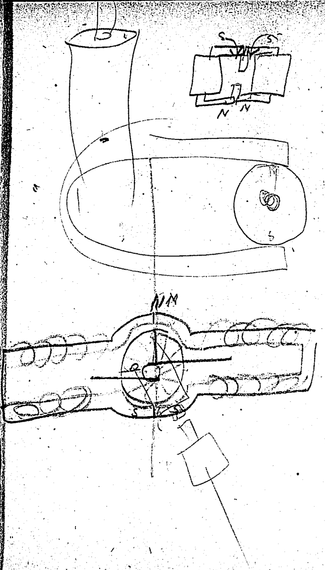
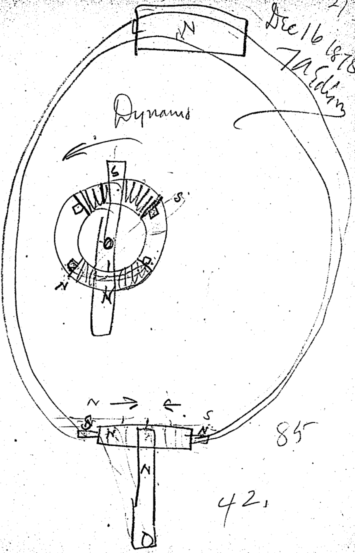
N


N
S
N
N

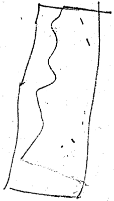

S
S
N
N
S
N
S

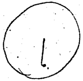
Dec 16 1878
TA Edison

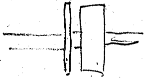


85

42,







6) 320

64
5
320

inch

64, 80, 960 —
480
320

2

100,

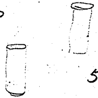
200.

2 hp —

Cop rod $\frac{1}{4}$ inch dia 30 inch length
Res $\frac{1}{2500}$ of an ohm, temp 1000

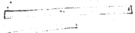
4

~~$\frac{1}{6046}$~~ ~~$2\frac{1}{2}\overline{)6046}$~~
~~3023~~ ~~1416~~



56

~~$\frac{1}{2500}$~~ 1416
2
2832



30

4. 8 16 32 64 —

5 10 20 40 80 2. 1

8

12 80. 96

3/4. .3

3/8

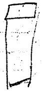
1/2. 1 1/2

4 8

1/2. 1

$\frac{4}{4}$

7/8. 3/4.



1

2

.4 200 27

23
11 ½

2.

5.4
1.0

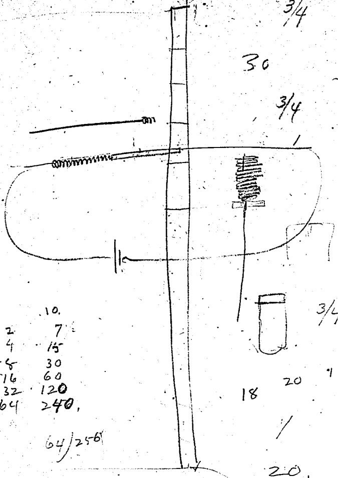
27

3/4

30

3/4

1



3/4

18 20 1

1

20

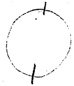
10

2	7
4	15
8	30
16	60
32	120
64	240

64)256

64
4
256

64
3
192



$\frac{1}{2000}$ $\frac{1}{10,000}$

$\frac{1}{4}$ inch 2 miles

1/2

1

2

4

8

.50
0250
0062
0087
1 3/4

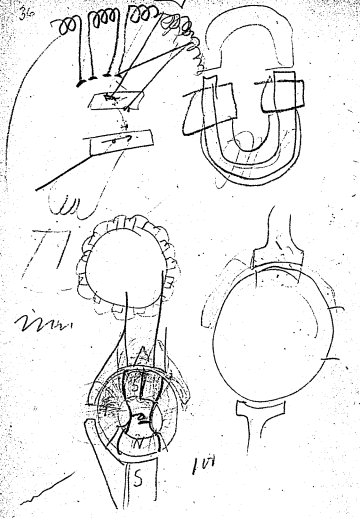
62 1/2
4
248

1. 500 50

2.

Railway

Boston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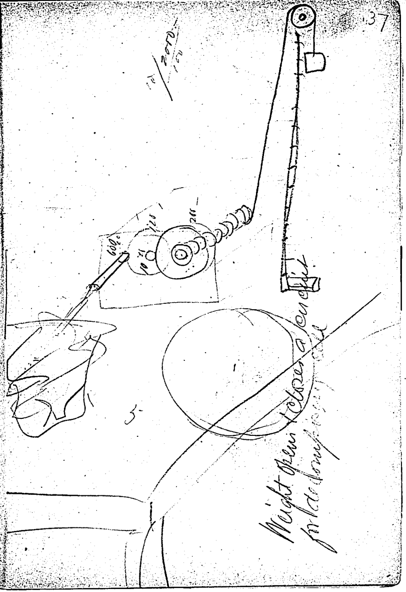
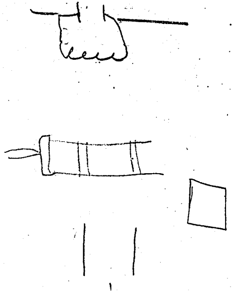
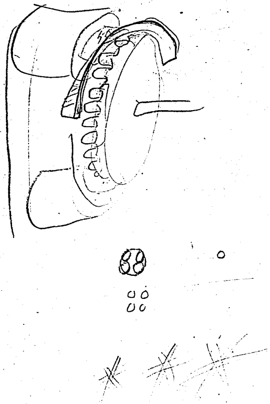
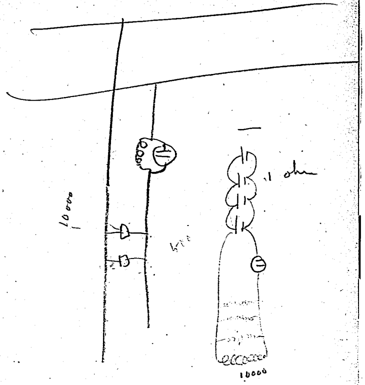

Weight drawn & closes a circuit



10





$$C = \frac{E}{R+r} \qquad C = \frac{E}{5000+1}$$

$$C = \frac{E}{2500+1}$$

42

$$4096 \overline{)1352000}(330$$

12288

12320

12288

320

$$C = \frac{4}{10000 + 4}$$

$$C = \frac{1}{2501}$$

54 × 7 = 378

65 × 65 = 325 + 390 = 4225

4225 − 4096 = 129

4096 : 4225 :: 320 :

320

84500

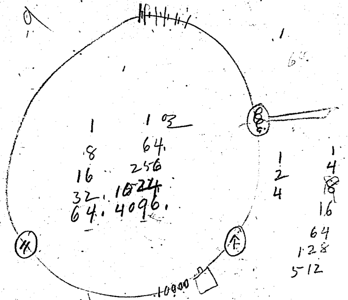
12675

1352000

43

1 4096.

1 2 1, 64.



1 2 4

1 4 8 16 64 128 512

64 5 320

$$C = \frac{e}{R + r} = \frac{1}{10000 + 1}$$

$$C = \frac{2}{10000 + 2}$$

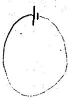
64) 320

65) 330.5

66
66
396
396
4356

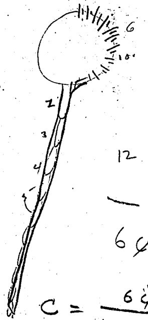
4225 : 4356 :: 330 :
330
130680
130680
4225) 937480 (340
12675
16998
0

1 ohm 1.03'



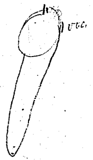
$C = \frac{E}{R + r}$

1 ohm 1 03



10,

40.



12 12 cells

64

$C = \frac{64}{1000000 + 64}$

$C = \frac{64}{1000000 + 64}$

46

$$\frac{80}{100000 + 80}$$

$$\frac{80}{100080}$$

$\frac{2}{252}$ $\frac{1}{126}$

$\frac{1}{126}$

80
80

4356 : 6400 :: 340 :

340
256
192

4356) 2176 (500

~~174224~~

~~80~~

21786

974

160

47

$\frac{64}{6400}$ 6.2

6

$\frac{12}{1000}$ $\frac{3}{250}$

16

$\frac{2}{125}$ $\frac{1}{81}$

$\frac{1}{62}$ 14 200, 2800 16, 3

500,

3

72

22

66 15 330 66 1090

14 20 280

200,

72

14 70 980

36,

6 18 6 108 3

36, 40 6 240

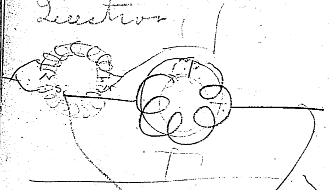
67

47

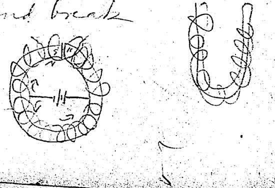
7568960

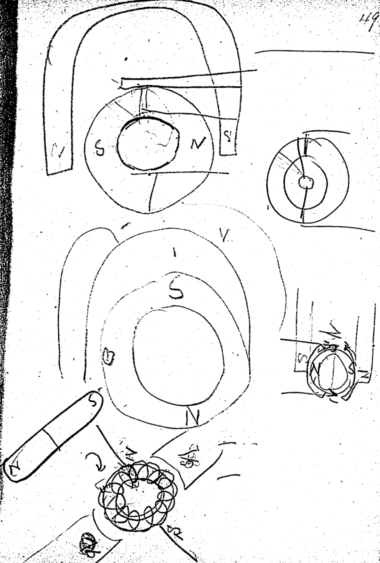
56 5 45 6 270 46 6 276 47 6 282

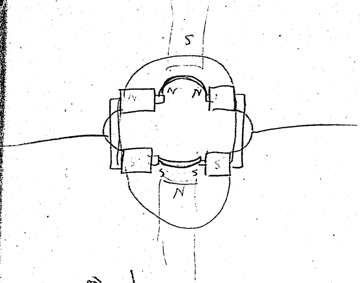
If a battery works
against a Gramme
Question



Gramme machine
moves about the same
How much power
Hand break



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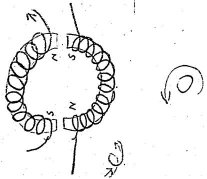
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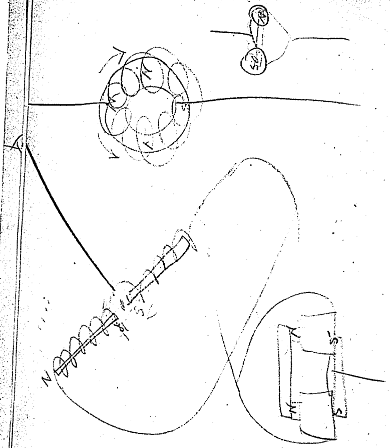
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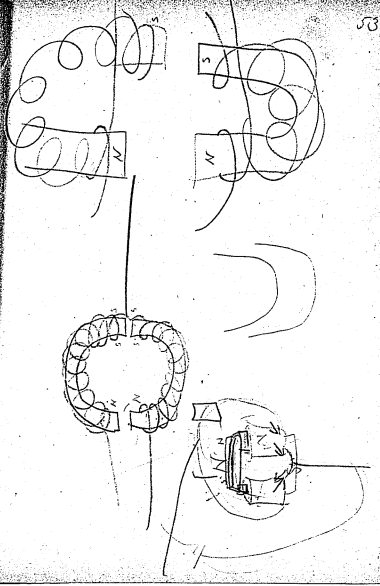
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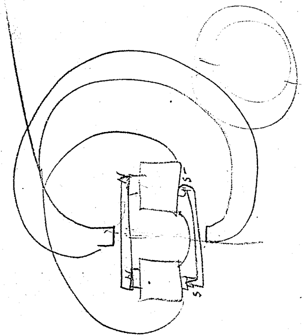
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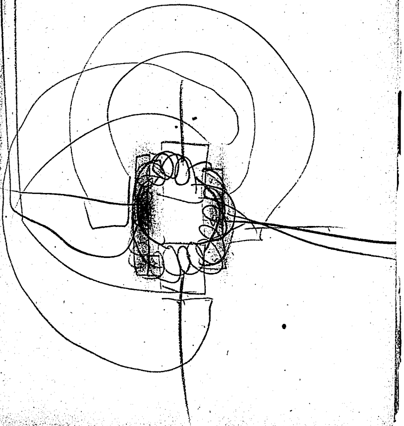
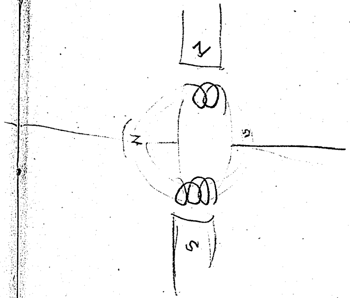
5

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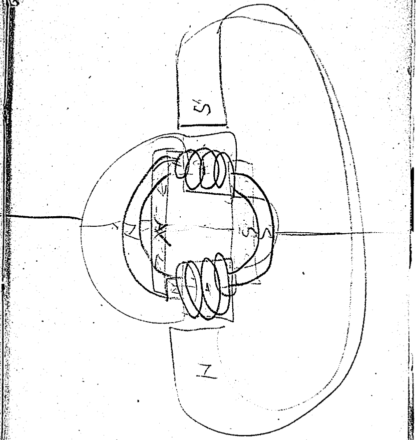
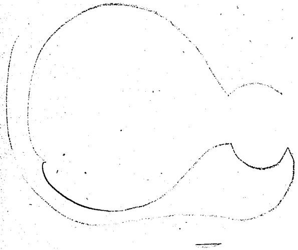




3. No. 36 Wire

00.4 3 ft long

.008

3.14
.004

3.14
.0004

3.14
.004

0.01256

r^2 3
3

.01256
.36

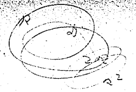
7536
3768

.45216

3
36

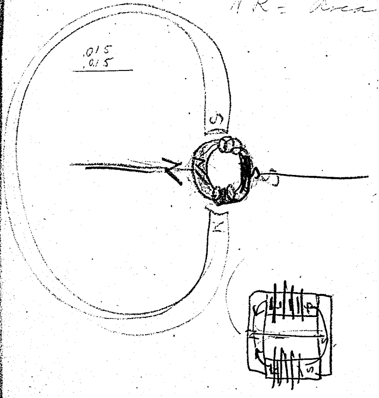
3.14
.004

.01256
36



R
πr
πD = circ
πR^2 = Area

.015
.015



$\frac{1}{10}$

$\frac{3}{10}$ 3000°

$1\frac{1}{2}$ 4'

$\frac{3}{2} \times \frac{10}{3} = 5$ Lamps

10 Lamps

Tried magnet

tried commutator

Six lamps all red heat from the 3 —

Six lamps $\frac{1}{4}$ in

$\frac{1}{2}$ HP 3000° 7

$1\frac{1}{2}$ inches $1\frac{1}{2}$

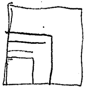
$\frac{1}{2}$ 3 Flames

$4\frac{1}{2}$ to 5 Burners to HP

$\frac{3}{8} \cdot \frac{3}{32} = \frac{9}{256}$

8.

8 inches



.015
8
.120
.3 ω
.36
9
.27

$\frac{3}{4}$ $\frac{3}{16}$

9

6~~8~~4) 9.0 (14
64
260
256
4

256.) 9.00 (35
768
1320

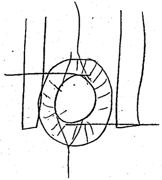
~~.035~~
.27

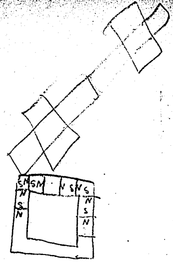
.105
.27
.375
.27
.645
.052
.697
.84
1.53

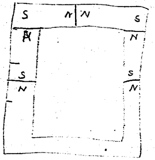
$\frac{7}{10}$ inch

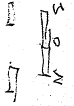
.14
6
.84

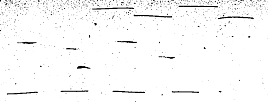
.84
.27
.27
1.38

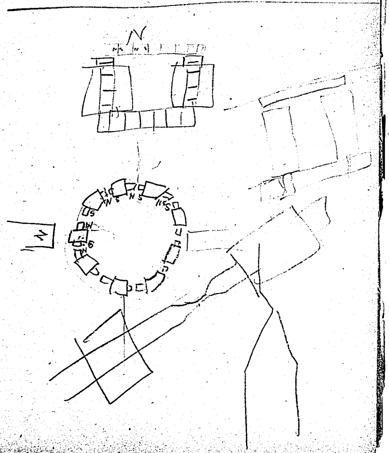


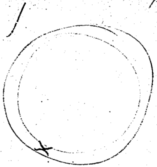


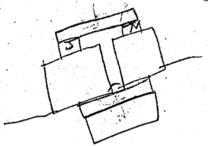


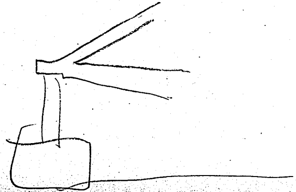


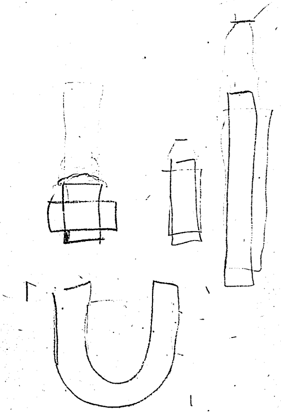


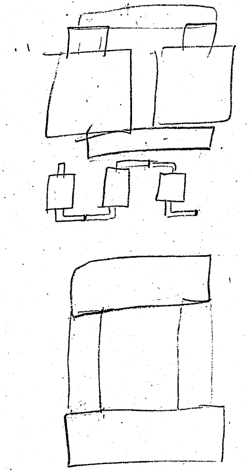


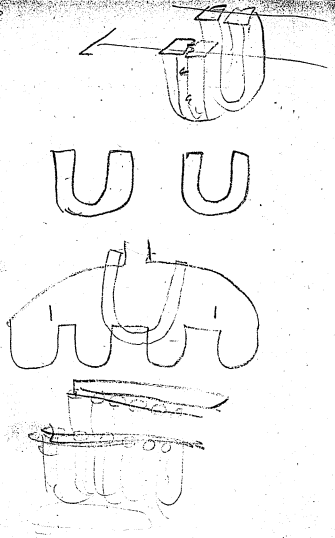


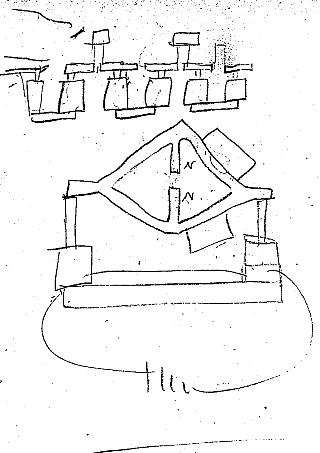








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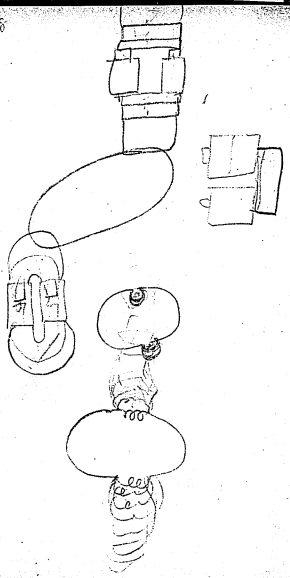

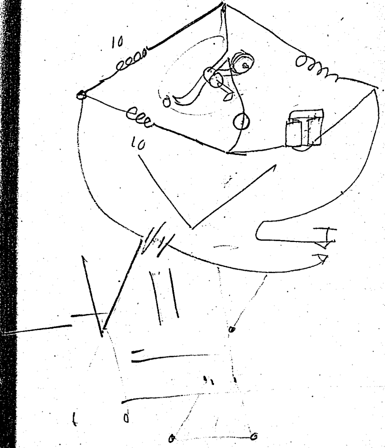
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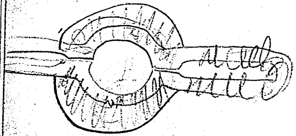

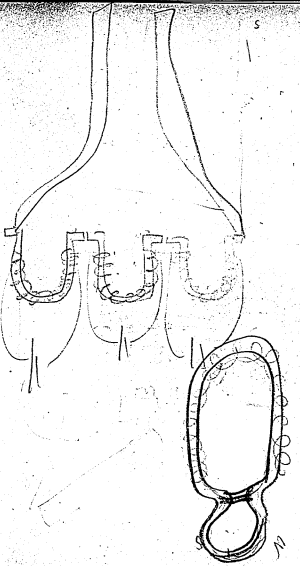

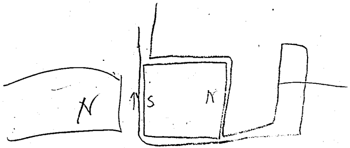
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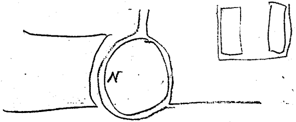
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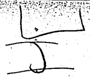

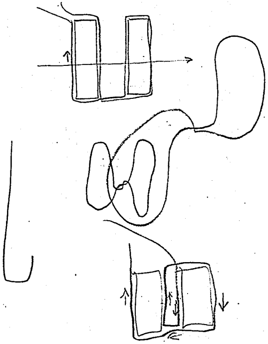

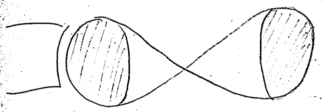

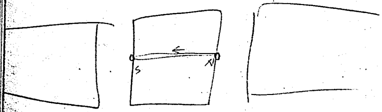
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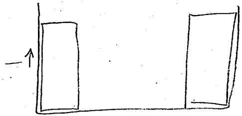

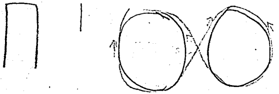

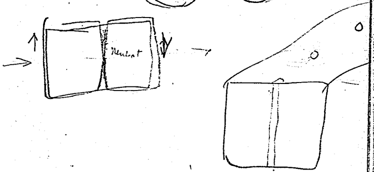

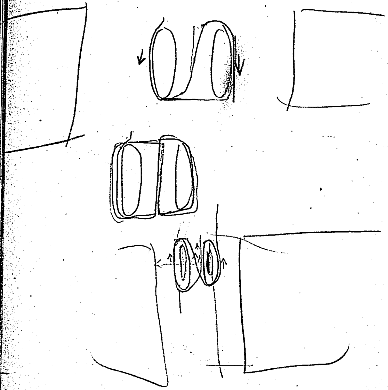

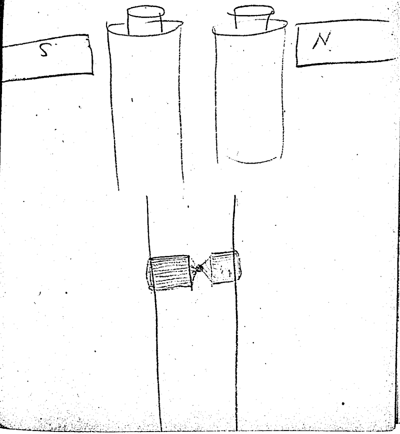
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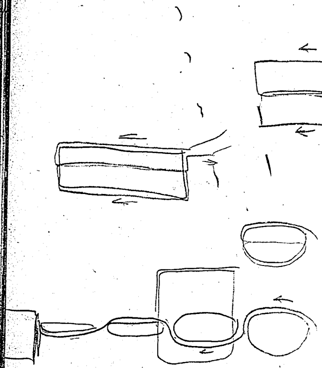

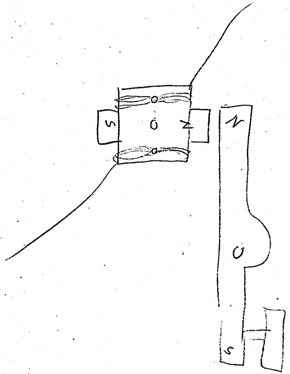
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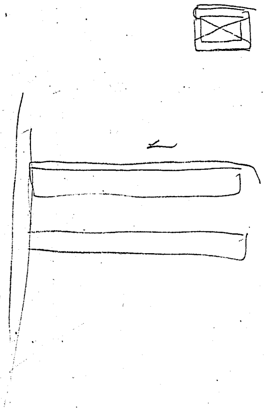

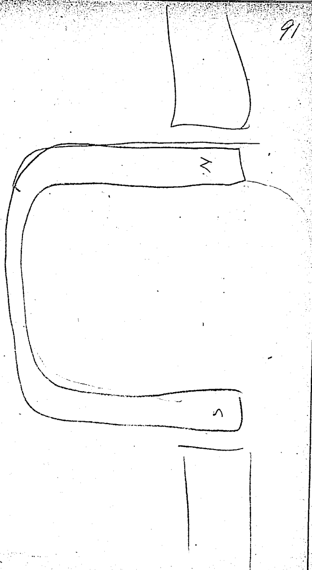

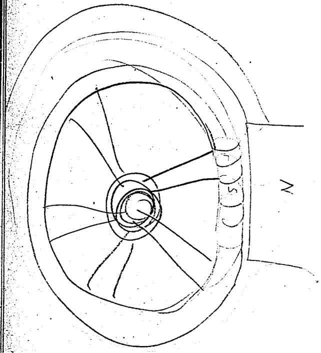
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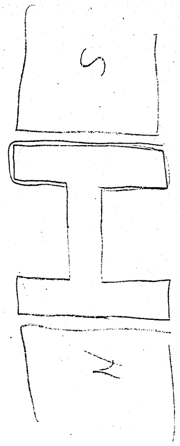
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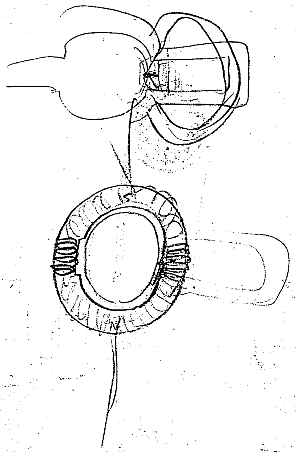
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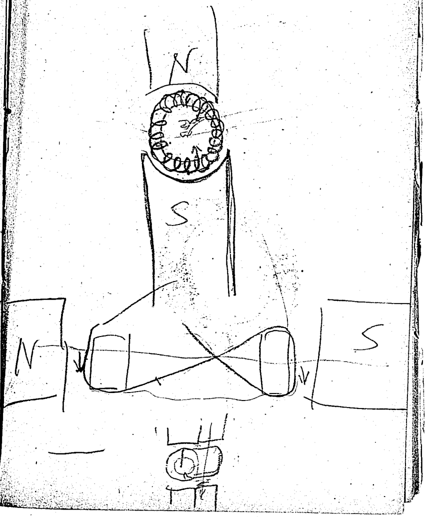
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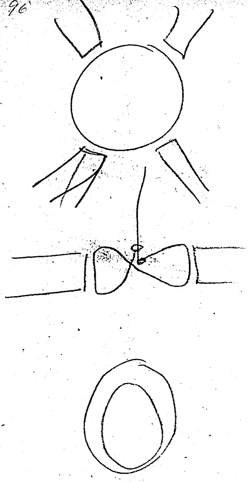

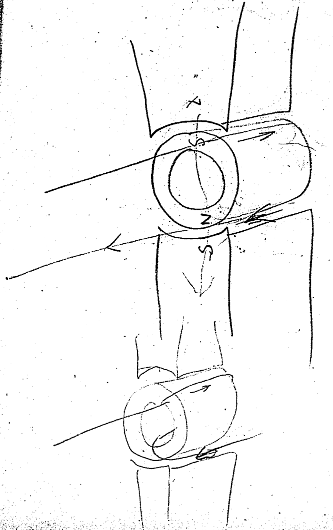
x
S
Z
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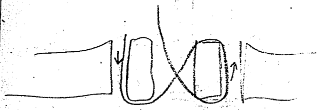

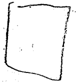

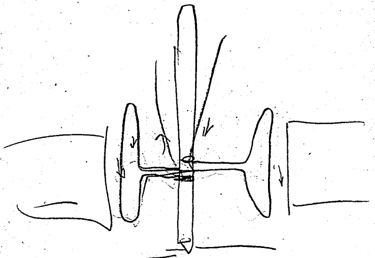

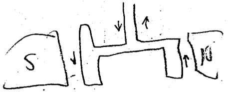
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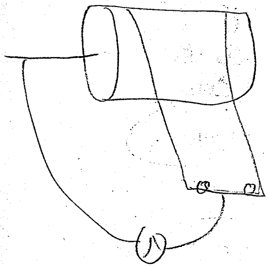

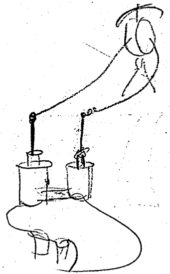

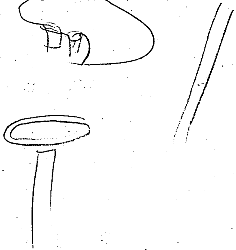

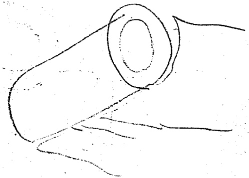

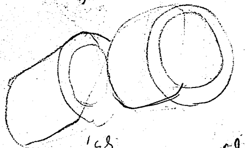

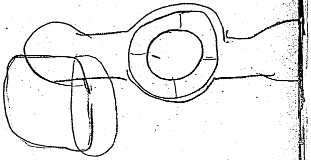

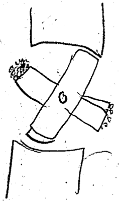

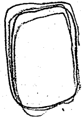

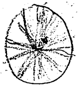

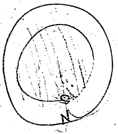

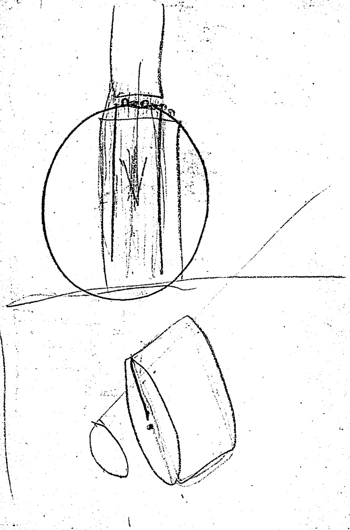

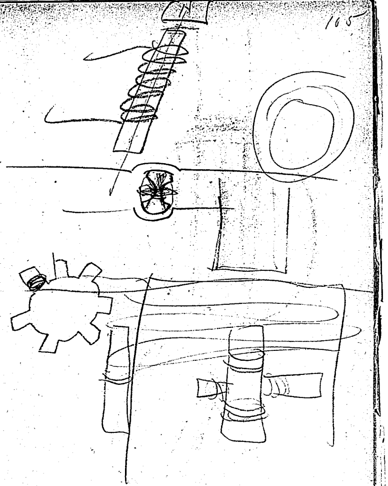

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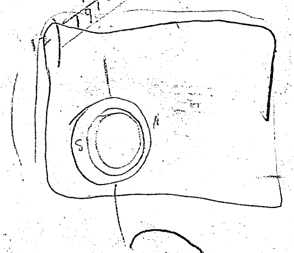
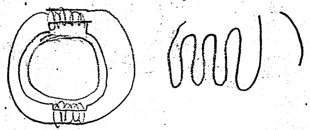
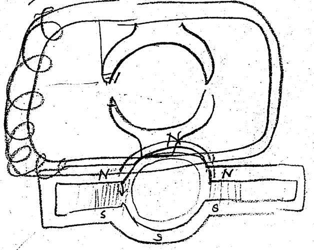
1910

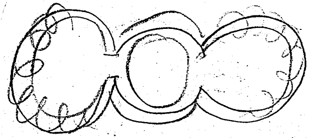


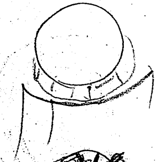


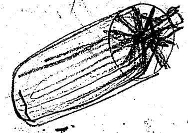
32
6
192

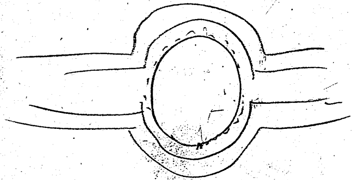
3/2

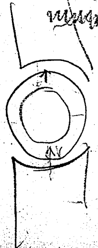


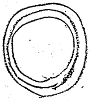


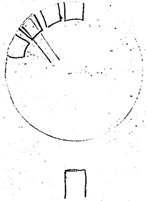












John Ott

Blackwalnut or better cherry -

No 1

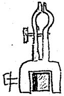
Edison Laboratory Note Book No. 9

Pages 111 to 126.

Incandescent Electric Light.

See Edison Patents:

214,636	214,637
218,866	227,227
227,228	227,229



Smaller one. 2 feet long —

Edison Laboratory Note Book No. 9

Pages 111 to 126.

Incandescent Electric Light.

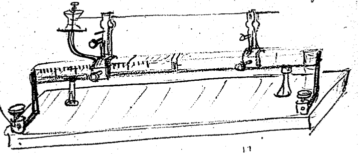
See Edison Patents:

214,636	214,637
218,866	227,227
223,898	227,229

John F Ott

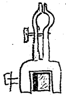
Black walnut or better cherry —

No 1



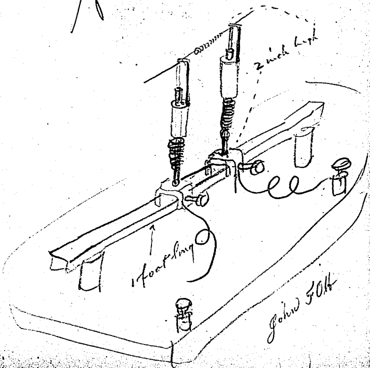
10 feet long.

divided whole length into 1/16, 1/4 1/2 & 1 inch marks.



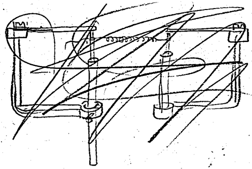
Smaller one. 2 feet long —

No 2



John Ott

$$\begin{array}{r} 960 \\ 772 \\ \hline 1920 \end{array}$$



$$\begin{array}{r} 960 \\ 772 \\ \hline 1920 \\ 20 \end{array}$$

$$\begin{array}{r} 772 \\ 1000 \\ \hline 772000 \end{array}$$

23.

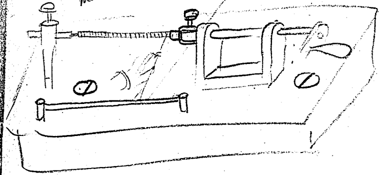
No 3

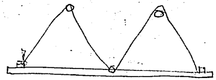
Jan 14 1879

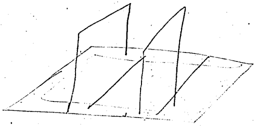
Chas Batchelor

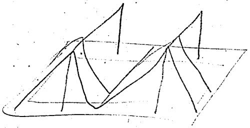
Mandrels with threads cut in to keep wire apart,

Make it to take 9 inches

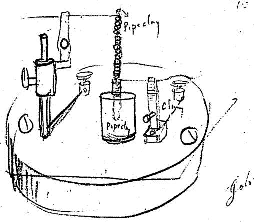






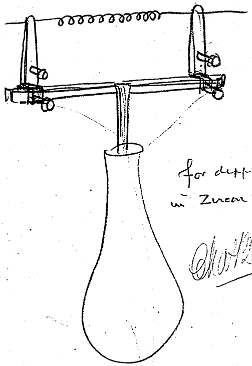


No 4



John F Ott

No 5 Jan 13th 1879



for dipping
in Zircon Solution,

Chas Batchelor

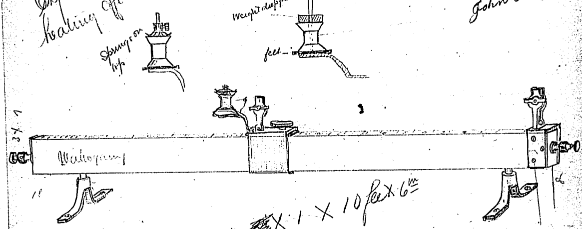
$1\frac{1}{2} \times \frac{5}{8} \times 2^{ft}\,4^{in}$

Jan 9 1879

Chas Batchelor

John F Ott

Experimental Inst for testing effects on wire

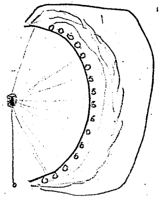


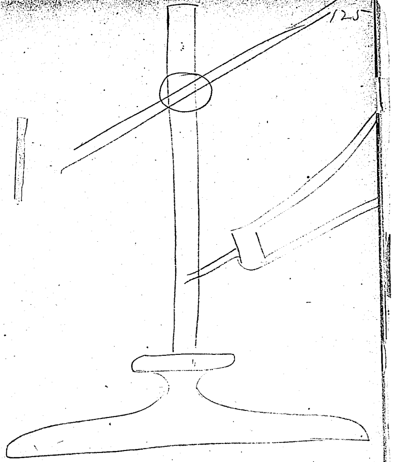
3 × 1 × 10 feet × 6 in

Concentration of heat

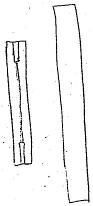
Jan 9 1879

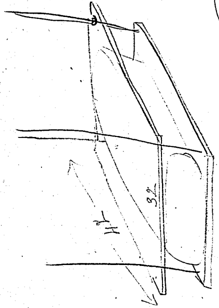
Chas Batchelor





Pages 127 to 162. "Dynamo Sketches, &C."
(Unimportant)

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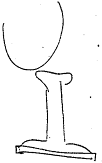
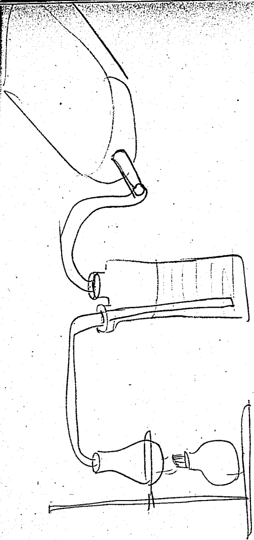
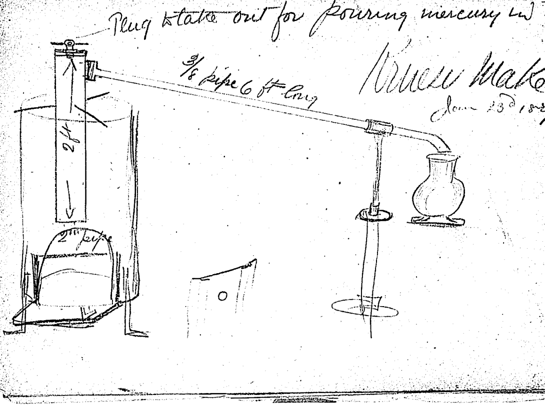
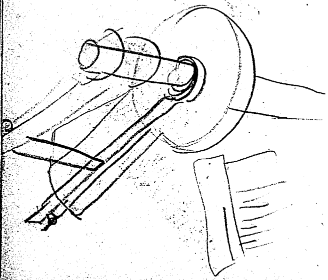
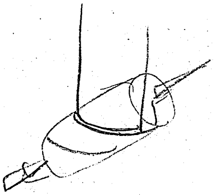






June 23d 1879





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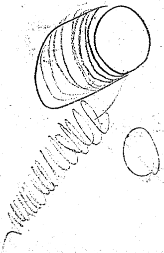
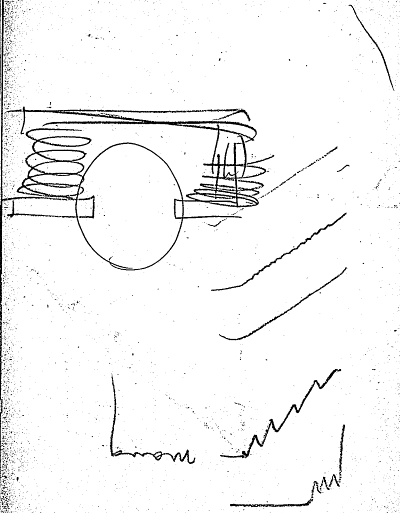
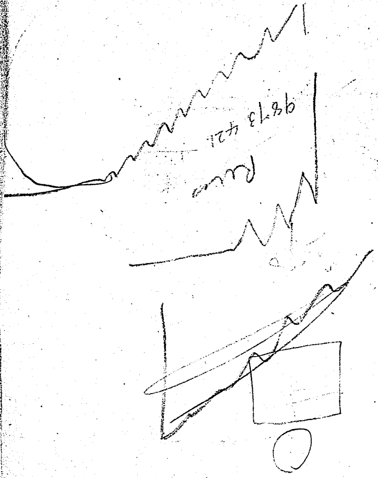
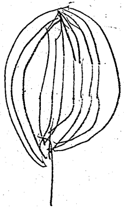


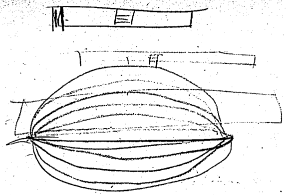




Wire 1 Ohm

~~Throw one unit of energy~~





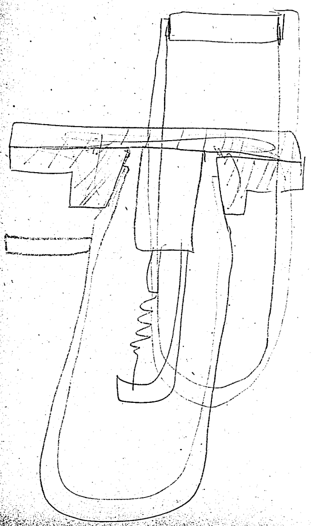
$\frac{1}{10}$ $\frac{1}{10}$ $\frac{1}{10}$

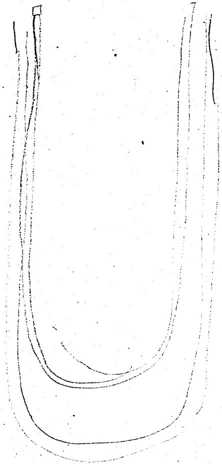
1 unit of energy

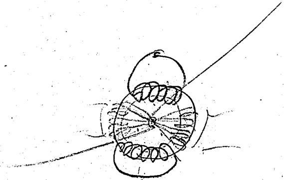
1 Unit of Energy

in 1 Ohm

10 Ohms twisted $\frac{1}{10}$







New 10.2 mg 100 mms

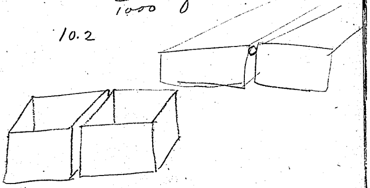
$$\frac{\frac{10.2}{1}}{31.103} \text{ oz}$$

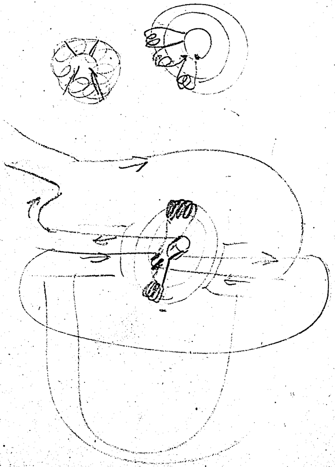
1.0086
4.5072
1 48 41

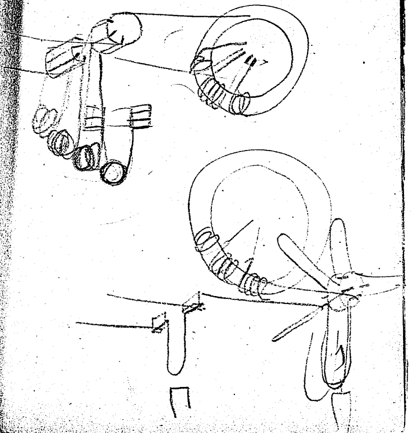
$$\frac{10.2}{31.003} \quad \frac{1}{3000}$$

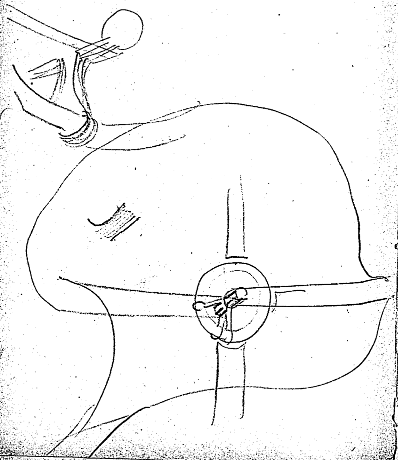
$$\frac{2250}{1000} \text{ oz} = .02 \text{ cts per foot}$$

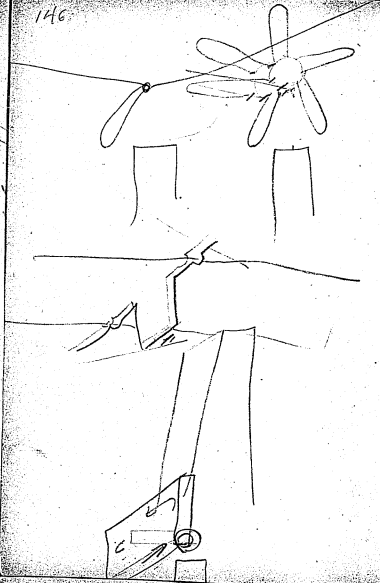
10.2

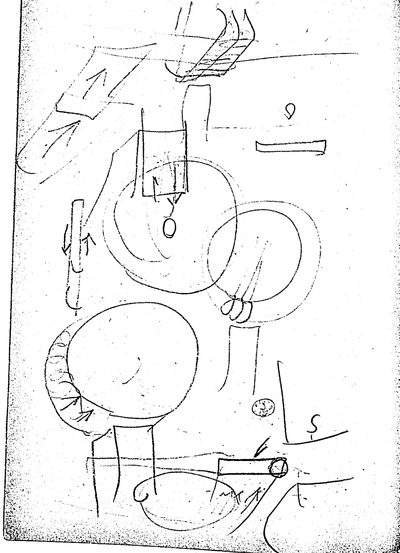


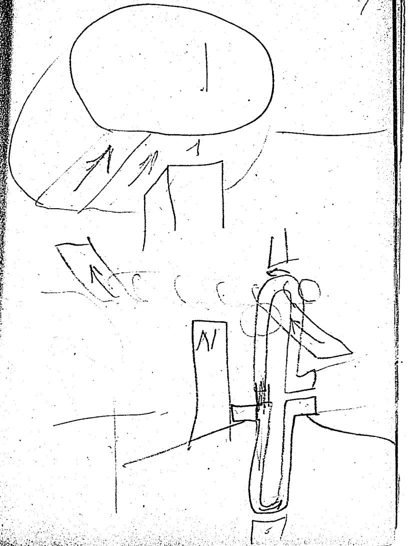


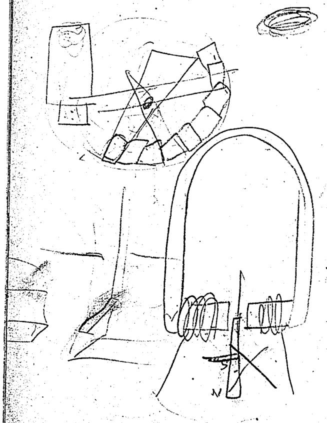








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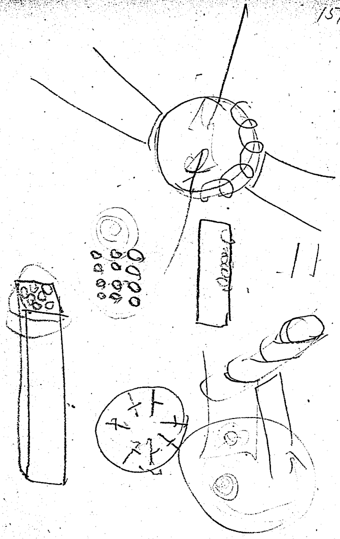

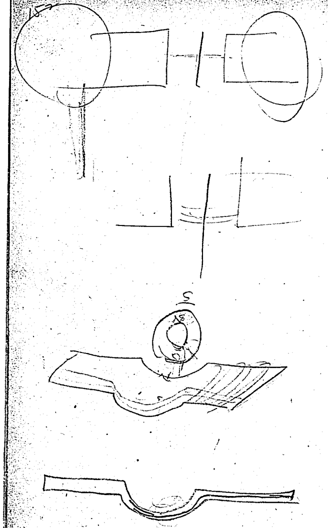
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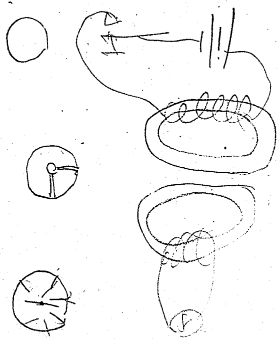
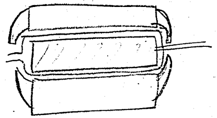
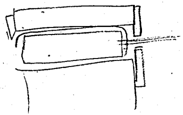
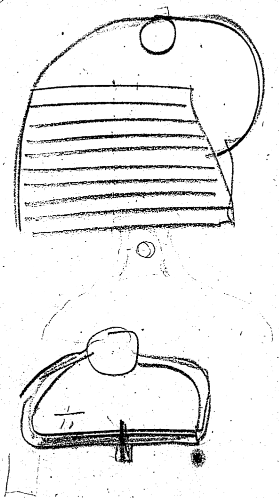
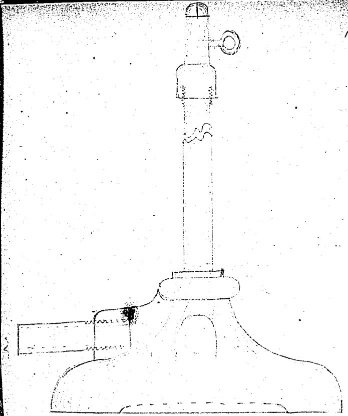
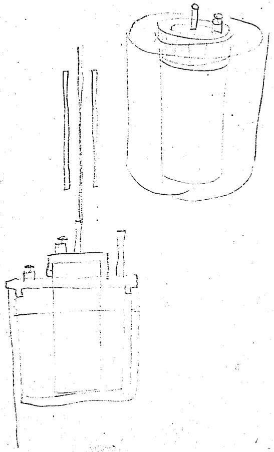


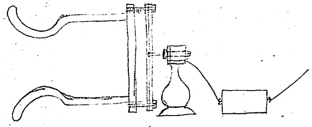








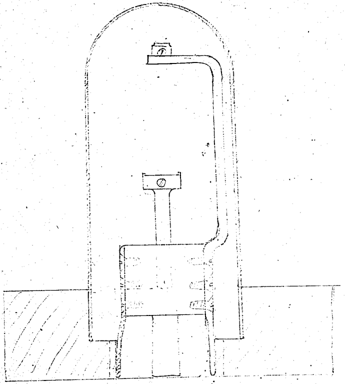




162

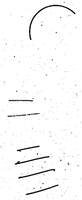
Febr. 10 to 1880 Vacuum experiments for electric light. J.K.

Chas Batchelor

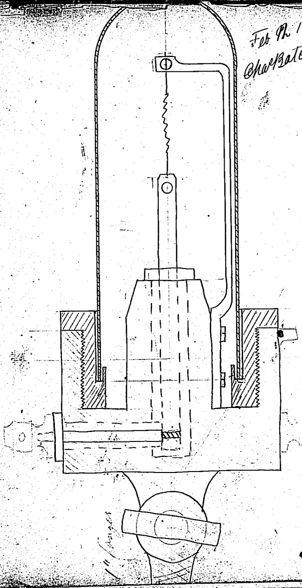


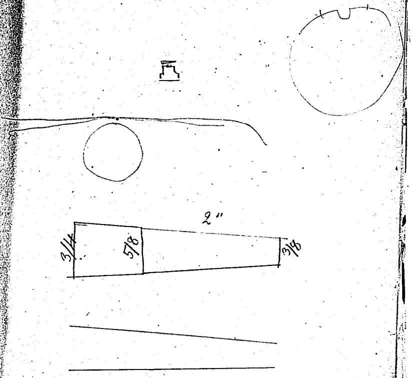
100

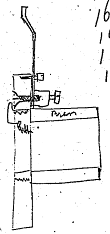
.005



Feb 9th 1879
Chas Batchelor



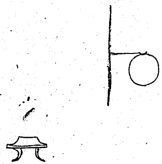

2"
3/4
5/8
3/8



16 Bindposts
16 Springs
1 Rubber plate
1 Brass bush.

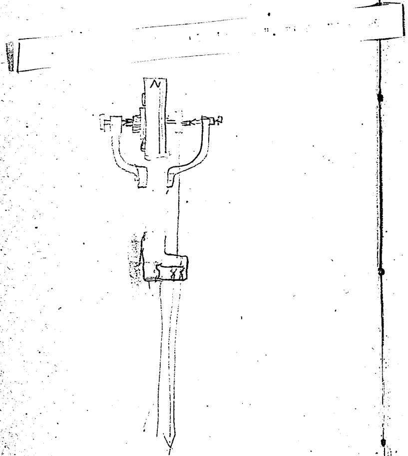
Edison's Magneto

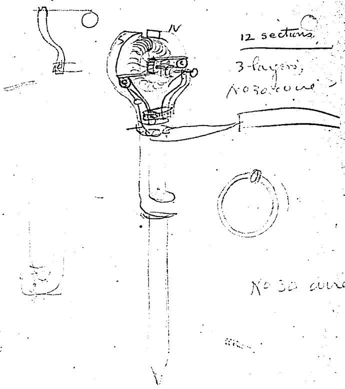
When making another machine fasten down the armature wire that runs in groove on shaft by a thin sleeve



Feby-16 1879

T.A.E

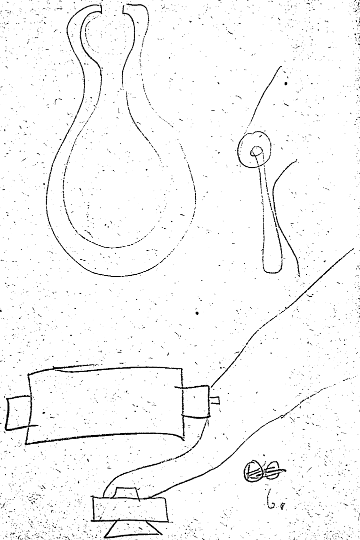




12 sections.

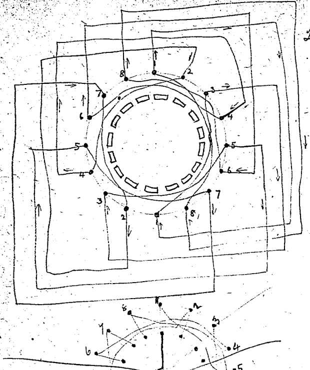
3-layers,
No 30 wire

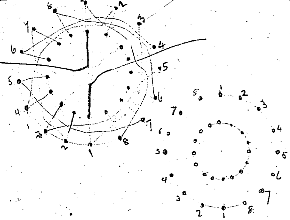
No 30 wire



Feb 15 1879

Batchelor



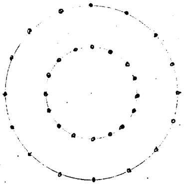


Com

1 = 1 coil in

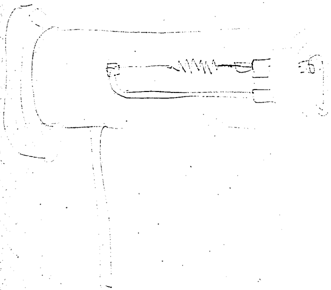
2 - 1 coil in

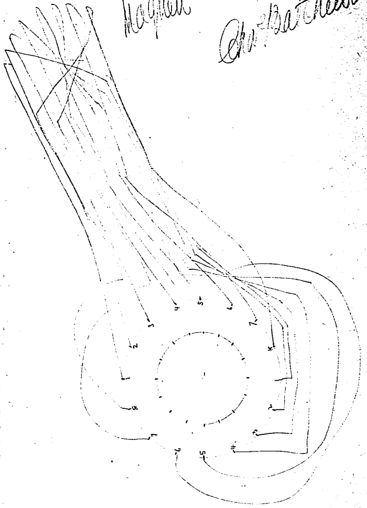
3 . 1 coil in

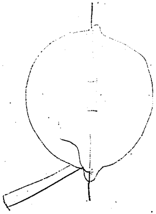


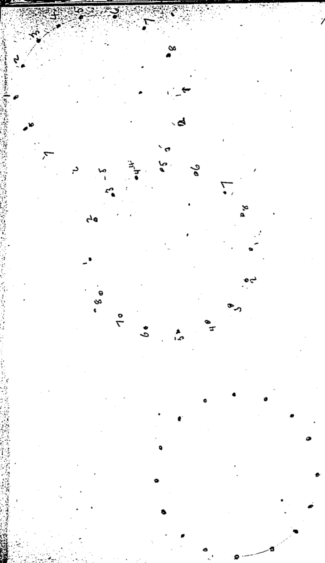
Magnets ~~Oct~~ 15 1879

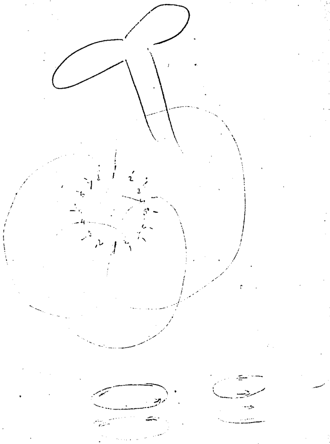
Chas Batchelor





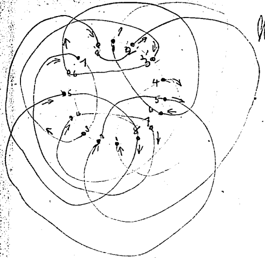


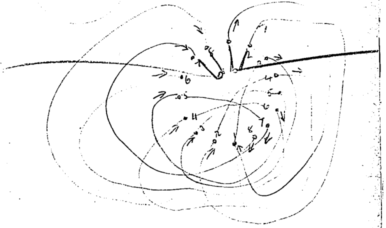


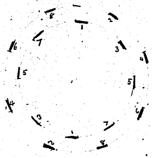


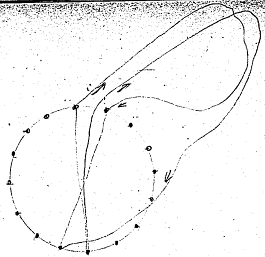
Magnets — Feb 15 1879

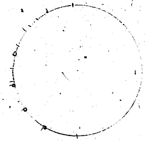
Chas Batchelor





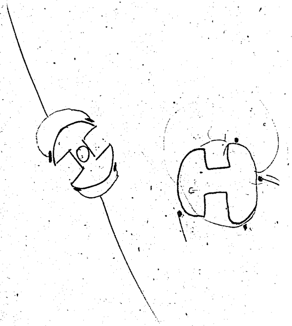


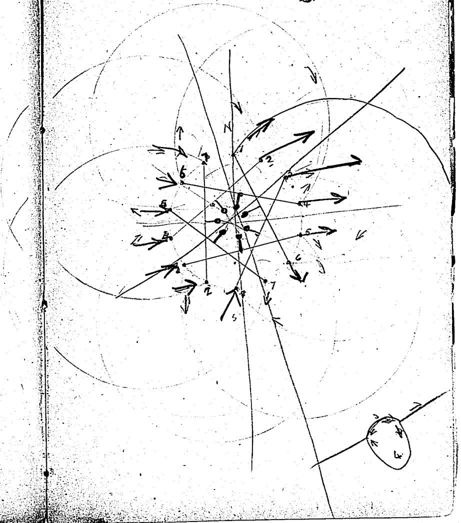


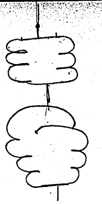


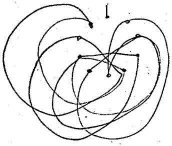
Feb 16 1879

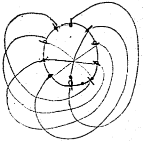
Chas Batchelor

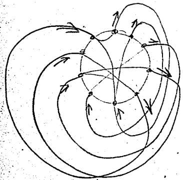


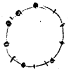


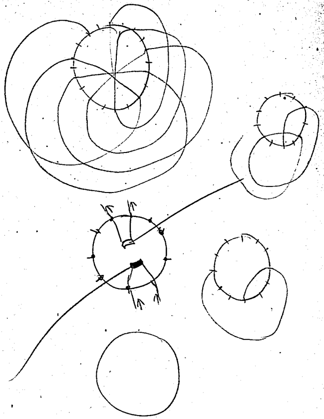


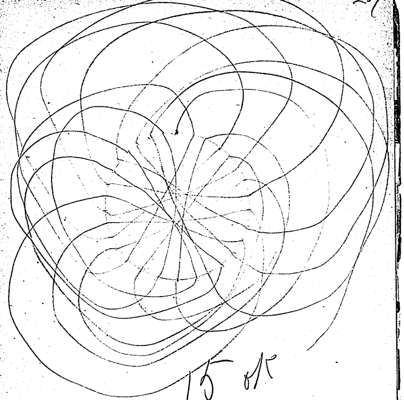








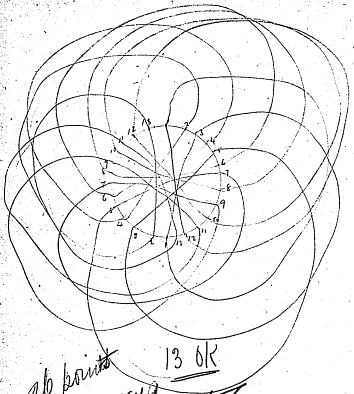




15 ok

31 points Feb 15 1879

Chas Batchelor



26 points

13 OK

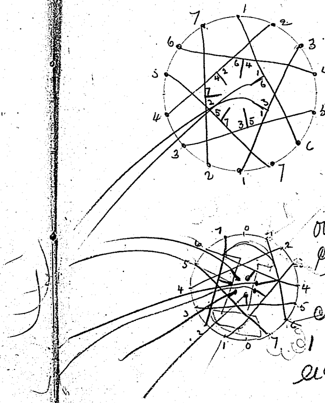
Feb 15 1879

Chas Batchelor

Pages 191 to 211."

35.8   18.9

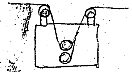
Feb 17 1899
Chas Batchelor

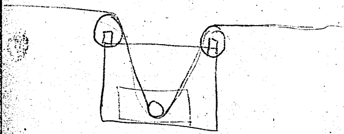


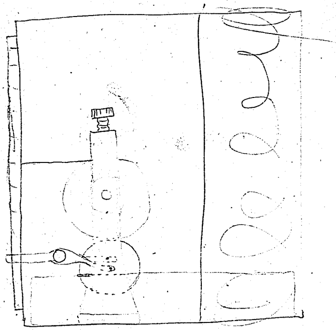
Connections for 7 coils

our machine connected as for 7 coils cutting out 1 coil of the eight

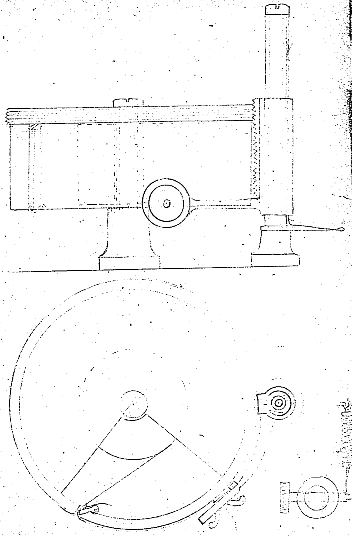
Pages 212 & 213."Edison Electro-Motograph Telepho
Receiver Sketches." (Unimportant)



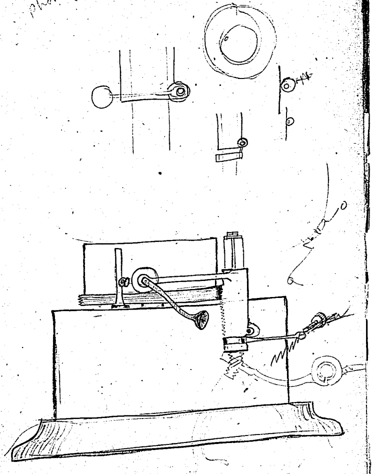


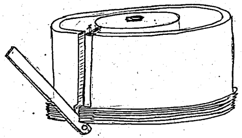


Pages 215 to 205, "Edison Phonograph Sketches."
(Unimportant)

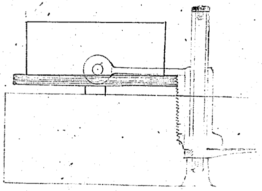


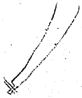
Phonograph

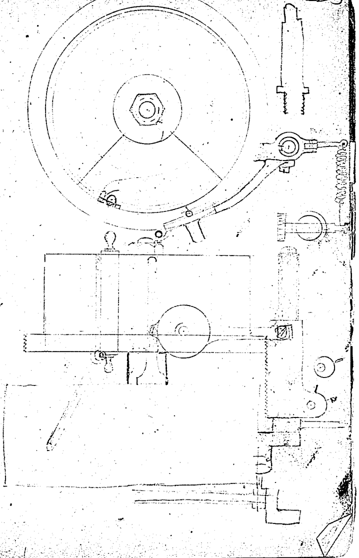




x is small lever to push the sliding piece in
and out there is also one on bottom



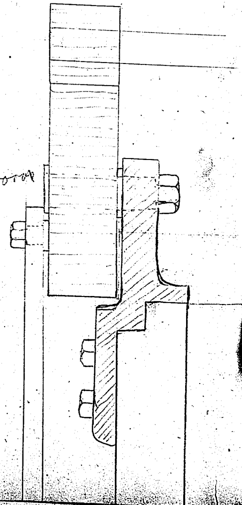




6
3
18

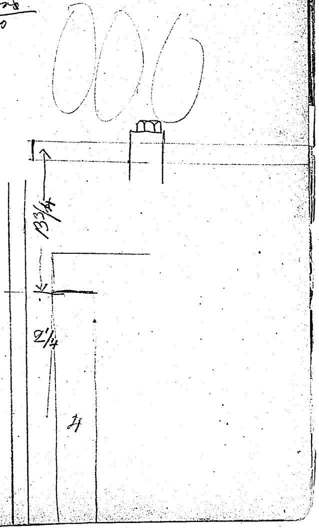
100) 18000

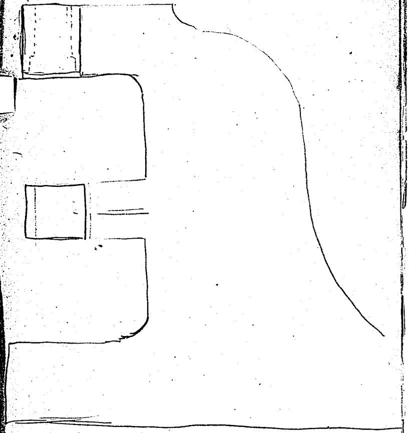
180



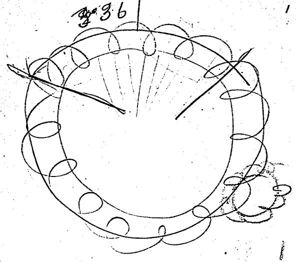
1 66) 132 19 228
62 38

20) 18000
900





.3 .33
1 .2
.1
.1
.05
.02
.02
101



2.1
4
.84

3.36

1.68
1.68

.84

100

.005 in Wire

10% Pt Ir.

500 mm 14.6 Ohms

20% 500 mm 12.9 ohms

Platinum 5.7 Ohms

$$\begin{array}{r} \bar{4}.9999 \\ 1.0066 \\ \hline \bar{3}.9913 \end{array}$$

.005

Platinum

500 mm

$\frac{1}{2}$ metre = $\frac{3.28}{2}$ ft = 1.64 ft

10%	14.6	1.1644	
	1.64	9.7852	
		0.9496	8.9
20%	12.9	1.1106	
	1.64	9.7852	7.8
		0.8958	
Pt	5.7	0.7559	
	1.64	9.7852	
		0.5411	3.4

per foot

35.1 1.5453
9.7852
1.3305

20.9 1.3201
9.7852
1.1053

3.23 0.5092
0.2944

18.9 1.2765
9.7852
1.0617

3.56 0.5514
9.7852
.3366

71.4 1.8537
1.6389

11.4 1.0569
0.8421

.41 $\bar{1}$.6128
$\bar{1}$.3980

500 mm

		Wt 100 mm	500 mm	~~1 foot~~
20%	.003	10.2 mg	35.1	~~21.40~~
	.004	17.4	20.9	12.7
	.005	27.2	12.9	7.9
	.010	109.	3.23	1.97
10%	~~.003~~			
	.004	17.4 mg	18.9	11.6
	.005	25.8	14.6	8.9
	.010	104.	3.56	2.17
Pt	.001	~~4.8~~ 2.87	71.4	43.5
	.004	19.4	11.4	6.95
	.005	359	5.7	3.4
	.02	475.	.41	.25

20%

17
68
8.5

~~98 mm~~
98 mm .0273

Pt 200 mm 950 / 47.5

*Calculated from resistance

Wanted Cost per oz ~~cost per Ohm~~

~~Length per Ohm~~

Cost per foot

~~Length per Ohm~~

Weight per foot

Feet per oz & per grain

Weight per Ohm

Length " "

Cost " "

Ohms per foot

100 mm = .1 metre = $\frac{3.2808}{10}$ = .32808 feet

= 3.937 inches

1 mg = .0154 Grains

= .0000322 oz

$\frac{.32808}{.0154}$ ~~metre~~ Feet ~~feet~~ per grain when

100 mm weigh 1 mg

inverse grains per foot

$\bar{1}.5161$
$\bar{2}.1875$
1.3286
$8.6714 - 10$

$\frac{.32808}{.0000322}$ = Feet per oz

inverse oz. per foot

$\bar{1}.5161$
$\bar{5}.5079$
4.0082

500 mm an Ohm

Length per Ohm inverse Ohms per foot

in inches X 12

Weight per Ohm

Length per Ohm multiplied Wt per foot

Cost per Ohm X price per oz

cost per foot

20% .003 Wire
Wt 100 mm
10.2 mg

351

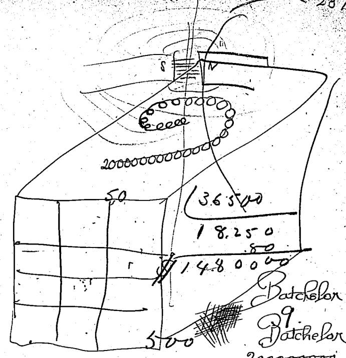
Capitalize each
$16. for Central
Station
15

3000

35.

Each Station 75
of 3000 hp or
Cap of 18000 burners
90.
300000

Can control each station
having 3000 hp for
90 dollars per hp
which includes Dynamo
Engine Boiler shafting
& every appliance



36500
18250
.80
$14800 00
Batchelor
9.
Batchelor
200000000
300 Batchelor
200000000000000000
Batchelor

1 2.

2.

160
10
1600

365
1600
219000
365
684000

1,74
80
5920

80
59
139
10
1390
365
6950
6950
834
4170
507,350

507.350

480) 2,247.00 (46
1920
3270
2880
3.9 00
3.

80 hp Engine

burner $1\frac{74}{100}$ coal per hour per h.p.
would consume in a year 225 tons

Coal at 350,	788,00
Wages 1 engineer at 350,	912.00
Stoker	547.00
	2,247,00

or \$ $4\frac{68}{100}$ per annum.

1 mil & 1/3 per hour.

or 1 1/3 cents per burner

per day of 10 hours.

according to his own
Estimate. the cost of
~~1 per~~ each burner for
a day of 10 hours, is
4.93. per year.

~~Of~~ a gas jet burning 5 feet per
hour. for 10 hours daily
for 365 days will burn
18.250 feet, the Cos
Charge ~~the~~ public for
this 41.06, These gas
Engineers will whisperingly
tell that no one knows
how cheap gas can
be made but they
will admit that it

cannot be made & delivered
for less than 60 c per
thousand feet, this being
the case the actual cost
of the gas ~~to a~~ consumed in
1 year from 1 burner of 10
hours is 10.96. cents.
now the wear & tear interest
in plant is ~~one~~ as great
with gas as with the El
hence taking his own
statement the cost of
a given light when
supplied by Electricity is
$4\frac{93}{100}$ per annum & of gas
10.96. to say nothing
of the Electric Light
being a much better one

giving off no ~~fumes~~ sulphurous
carbonic acid or vitiating
the atmosphere by
burning the oxygen
or blackening the walls

A capitalization of 22
dollars per lamp
will cover every cost,
but for main conductors
+ central stations +
Lamps =

+ perfectly accurate
Experiments have shown
that a company
exploiting the Electric

Light can produce in the
house of the consumer as
much light ~~from~~ 4 to 5 times
less money than it can be
supplied by burning gas —

7000	3.8451
16	1.2041
	2.6410
	.3200
437.5	2.9610
200	

914. instead of 999.

20% .003 500 mm 90/ an oz $2250 an oz

Wt 100 mm 10.2 mg 1.0086
1.3286

2.09 ft per grain .3200

7000/116 grains per oz ld
2.6410

914 ft 2.9610

Wt per foot 1.6800

.488 grains

.00109 oz 3.0390

cost per foot 225 1.3522
2.3912

$ .024

mg per foot 1.6500
.6456 mg 2.8116
.4916

3.102 mg per foot

1.5084

.322 ft per mg

R 500 mm
35.1

21.4
Ohms per foot
Wt per ft

.0223
grains per Ohm
grains per oz
oz per Ohm
cost per Ohm

$.00115
cost per Ohm
ft per Ohm

.0467

1.5453
9.7852
1.3305
1.6800
1.3305
2.3495

2.6410
5.7085
1.3522
3.0607

2.6695

10%

.005

25.8

Feet per grain 1.3286
.4116
Feet per 100 mm 1.9170

25.8 mg in 100 mm

25.8 1.4116
5.5477 -10
6.9593
3.9593

1/28349

28349 mg in 1 oz oz in mg

4.4523

3.9593 oz
1.5159 feet
2.4434
.0414
2.4848

100 mm
1/.32801 ft

.0305 .6305

1/1000 oz 1/3 foot

1100/333 oz in foot

100 m

25.8 mg

28.000 mg to 1 oz

$\frac{1}{1000}$ oz

100 mm

$\frac{1}{3}$ foot

100 ~~oz in 1 foot~~ oz in 1 foot

$\frac{1}{333}$ oz

~~100~~ 333) 11.00 (3.3
999
1010

33 cts

5 inches .02 Rt

100 mm

.475 mg

.475

$8.15

$\bar{2}$.6767
5.5477 - 10
$\bar{1}$.5159
0.9112
5.6515
$\bar{4}$.6515

$\frac{475}{28.000}$ $\frac{1}{3}$ .000448

28000)475

80000) 475.000 (.028

54 cts

475 $\bar{2}$.6767
4.448 5.5477 - 10
$\bar{1}$.5159 10.4841 - 10
.9112
41.2 cts $\bar{1}$.6197
16

$\frac{475.}{28000}$ X3 X11

475	2.6767
33	1.5185
	4.1952
	4.4472
	$\bar{1}$.7480

.56 cts

	475.	2.6767
comp	28349	5.5477 −10
comp log	.3280	10.4841 −10
log	8.15	.9112
		$\bar{1}$.6197

41.2 cts

$\frac{475}{28000}$ 3X8

475	2.6767
24	1.3802
	4.0569
	4.4472
	$\bar{1}$.6097

.407 cts

475. mg. in 100 mm

1 mg weighs $\frac{1}{28349}$ oz.

Wt 1 ft in ~~grams~~ oz. of wire weighing 1 mg. per 100 mm.

1 mg = $\frac{1}{28349}$ oz

100 mm. = $\frac{1}{.3280}$ ft

5.5477 −10
10.4841 −10
~~36~~
16.0317
$\bar{4}$.0317

.000205

multiply wt. 100 mm in mg = weight per foot mg

X cost oz = cost per ft

5760 grains in 1 lb. Troy

1.2153

3.7604
.0843
3.8447

6999

log 7000 = 3.8451

~~500~~
7000
16

~~1.2041~~
3.8451
1.2041
2.6410

437.5 grains in 1 oz avdp.

Cost per foot $\frac{.03}{3.75}$ | feet per $ | Weight per Ohm in oz | No. oz. in Ohm

$ .022 — 1.3522 / $\bar{1}.9999$ / $\bar{2}.3521$ — 44. 1.6479 — $\bar{4}.9999$ / 1.3385 / .000046 $\bar{5}.6694$

.032 — $\bar{3}.2318$ / 1.2729 / $\bar{2}.5047$ — 31. 1.4952 — $\bar{3}.2318$ / 1.1053 / .00013 $\bar{4}.1265$

.0403 — $\bar{3}.4289$ / 1.1761 / $\bar{2}.6050$ — 28 1.3950 — $\bar{3}.4289$ / 0.8958 / .00034 $\bar{4}.5317$

.136 — $\bar{1}.0287$ / 1.0969 / $\bar{1}.1256$ — 7.5 0.8744 — $\bar{2}.0287$ / 0.2944 / .00542 $\bar{3}.7343$

.024 — $\bar{3}.2318$ / 1.1383 / $\bar{2}.3761$ — 42. 1.6299 — $\bar{3}.2318$ / 1.0617 / .00015 $\bar{4}.1701$

.0281 — $\bar{3}.3978$ / 1.0511 / $\bar{2}.4489$ — 35.6 1.5511 — 3.3978 / .9496 / 4.4482 .000280 — $\bar{3}.3978$ / ~~1.0511~~ / ~~4.3467~~

.095 — $\bar{2}.0083$ / .9717 / $\bar{2}.9800$ — 10. 1.0200 — $\bar{2}.0083$ / 0.3366 / .0067 $\bar{3}.6717$

.0075 — $\bar{4}.4492$ / 1.3010 / $\bar{3}.7502$ — 180 2.2498 — $\bar{4}.4492$ / 1.6389 / .0000066 $\bar{6}.8103$

.019 — $\bar{3}.2791$ / 1 / $\bar{2}.2791$ — 53 1.7209 — $\bar{3}.2791$ / 0.8321 / .00028 $\bar{4}.4470$

.0310 — $\bar{3}.5500$ / 0.9420 / $\bar{2}.4920$ — 32 2.5080 — $\bar{3}.5500$ / 0.5311 / .00104 $\bar{3}.0189$

.374 — $\bar{2}.6643$ / 0.9096 / $\bar{1}.5739$ — 26 0.4261 — $\bar{2}.6643$ / $\bar{1}.3980$ / .185 $\bar{1}.2663$

Cost per Ohm | $

$\bar{2}.6695$
$\bar{2}.3521$
$\bar{3}.0216$ .00105
$\bar{2}.8945$
$\bar{2}.5047$
$\bar{3}.4092$ .0021
$\bar{1}.1042$
$\bar{2}.6050$
$\bar{3}.7172$ .00514
$\bar{1}.7015$
$\bar{1}.1256$
$\bar{2}.8312$ .0679
$\bar{2}.4383$
$\bar{2}.3761$
$\bar{3}.3084$ .0020
$\bar{1}.0511$
$\bar{2}.4489$
$\bar{3}.4993$ .00315
$\bar{1}.5628$
$\bar{2}.9800$
$\bar{2}.634$ .044
$\bar{2}.3611$
$\bar{3}.7502$
$\bar{4}.1113$ .00313
$\bar{1}.1679$
$\bar{2}.2791$
$\bar{3}.4470$ .0028
$\bar{1}.4689$
$\bar{2}.4920$
$\bar{3}.9609$ .00914
$\bar{1}.7020$
$\bar{1}.5739$
.2757 1.88

Ohms per $ | In long are Ounces

2.9784 950 — 0 $\bar{2}$.9914
2.5008 317 — 0 $\bar{2}$.9595
2.2888 194 — 0 $\bar{1}$.5624 365
1.1680 14.7 — $\bar{1}$ $\bar{3}$.9626
2.6916 490 — 0 $\bar{1}$.7594
2.5007 316 — 0 $\bar{1}$.5935 3.93
2.3566 230. — $\bar{1}$ $\bar{3}$.9830
3.8887 7700 — 1 $\bar{1}$.5421
2.5530 350. — 0 $\bar{1}$.7122
2.0491 112 — 0 $\bar{2}$.4478 276
$\bar{1}$.7240 .53 — $\bar{1}$ $\bar{2}$.3270

No. Ohms in 1 oz | Feet in ring

2100 4.3306 — .0322 $\bar{2}$.5073
7500 3.8735 — .0188 $\bar{2}$.2754
2940 3.4689 — .0120 $\bar{2}$.0797
184 2.2857 — .00304 $\bar{3}$.4785
6700 3.8299 — .01888 $\bar{2}$.2754
3550 3.5517 — .0127 $\bar{2}$.1043
210 2.3263 — .00319 $\bar{3}$.4989
154000 5.1897 — .114 $\bar{1}$.0580
3600 3.5530 — .0169 $\bar{2}$.2281
957 2.9811 — .00914 $\bar{3}$.9608
6.820 .8337 — .000069 $\bar{4}$.8429

No. Grains in 1 Ohm | No. m.g. in 1 Ohm

.023 $\bar{2}$.3506 — 1.45 0.1622
.064 $\bar{2}$.8077 — 4.1 0.6195
.163 $\bar{1}$.2123 — 10.5 1.0239
2.64 0.4155 — 168. 2.2271
.071 $\bar{2}$.8513 — 4.6 0.6629
.134 $\bar{1}$.1297 — 8.54 0.9313
2.25 0.3529 — 146 2.1645
.0031 $\bar{3}$.4915 — .2 $\bar{1}$.3031
.107 $\bar{1}$.0282 — 6.9 0.8398
.502 $\bar{1}$.7001 — 32.5 1.5117
88.6 1.9475 — 5750. 3.7591

27 Ohm
25 Lamp
2 Battery

1 Lamp
2 Ohms Battery

$C = \frac{E}{R} = \frac{1}{3}$

$\frac{1}{9} \times \frac{3}{2} = \frac{1}{3}$

$C = \frac{E}{R} = \frac{1}{27}$

$\frac{1}{27} \times \frac{1}{27} \times 27 = \frac{1}{27}$

$\frac{1}{27}$ is $\frac{1}{9}$ of $\frac{1}{3}$

$\frac{1}{9}$ as much energy total on 27 Ohm circuit.

$\frac{1}{9}$ $\frac{1}{3}$ Total.

$\frac{1}{9}$ in battery

Cost $\frac{2}{9}$ in Lamp

$\frac{1}{27}$

$\frac{25}{27 \times 27}$ $\frac{2}{27 \times 27}$ $\frac{27 \times 6}{142}$

$\frac{6}{27} = \frac{142}{27 \times 27}$

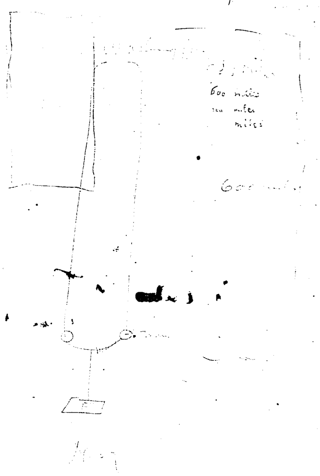
$25) 142 (5.7$
125
175

5.7 ~~times~~ more energy given off on 1 Ohm lamp than on 25 Ohm lamp.

Platinum wire marked
·005 measures in different
places ·00575 ·00590 ·0060

Platinum Iridium 10%.
Marked ·005 measures
·005 only being ·0049 in one
place near end

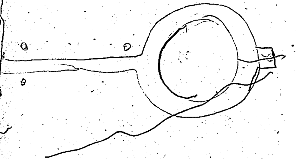
Plat Iridium 20%
Marked ·005 measures

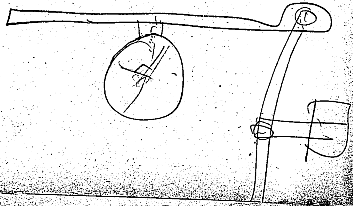


No. 1, 42, 305
2 43. 62

2 cells .5 Ohm

2-25
2. 47 22 minutes





.11363 Mg.

.00011363 Grammes

.0011363 $\frac{1}{10}$

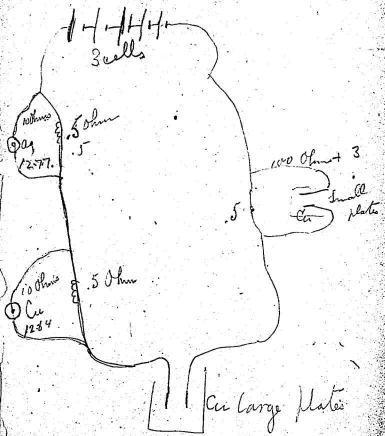
.011363

Daniell's element E = 11

Volt = $\frac{1}{10}$ Magnetic moist

.00093 E. B. .00094
000 0094
.00094

I want to try the following



Time 3-24 PM
7-45

e^2 3.24
R^2 4 21

60
240
21
261

7.8
3
5.4
1.5
1.0
7.9
8 Ohms

	log 3	0.4771	
comp log	8	9.0969	−10
comp log	1.14	9.9431	−10
log	3	0.4771	
log	1.015	0.0065	
comp	261	7.5837	
comp	60	8.2218	
		$\bar{4}$.8062	

.00064

Pt crucible

15.792

15.8975
15.792
.1055

Small bent Cu.

7.0752

7.0952
7.0752
.0200

Large plate
41.8672
.8336

4

Large plate corner cut

40.850

41.8338
40.850
.9838

L

without cut

40.986
39.940
1.046
983
63
32

983
32
1.015

26) 1.015 (.03

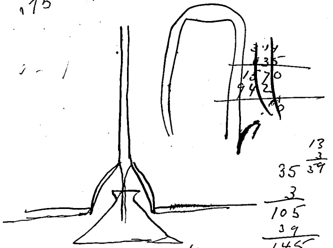
Small plate

12.5768
12.557
.0198

1030
.125

.016
11.996
.020

.175



13
35 39
3
105
39
145
130
615
.035

.035
.0175

3.14
.0175
.0175
5.9830

.4970
2.2430
2.2430

3868

.000967
4
.003868

30
31
720
31
3720

030
090
2700
130

.030
130
3900

.035

3.14
.0175
.0175

.4969
$\bar{2}$.2430
$\bar{2}$.2430
$\bar{2}$.9829

30 220
110 Volts

110
110
110
110
1210
443
3630
4840
4840

88) 536.03 0 (6.08
528
803
724
790

5.5 per H.P.

5360

3a) 22a
7.33
12
1466
733
87.96

6088) 33000 (5.4 per H.P
30440
25600
24462

154
16
70

13
52

.0175 $\bar{2}$.24304
.0175 $\bar{2}$.24304
3.14 0.49693
$\bar{4}$.98301

35
4
140
52
192
30
162

.0009617

.01
.01
.0001

0.961

30)961(32.0

.035
.035

.024
.162

.0009617
4
.0038472

.024
.162

30)384.7(1
138
30

35
5

.024
.162

.024
.162

162)3847(23
324
607
486
1210

1795049
5
8975245

61,162570
8975245
52,187325

7162360
-3275105
10437465
5
52187325

12,232514
1795049
10437465

7162360
5
35811800

7,484,~~000~~) 39,100,~~000~~ (5.22
37420
16800
14968
18320

624 3000
5
3,121.500

627.200
5
3136000

134.032
5

356,336) 670160 (1.8
35633
31380
~~32504~~

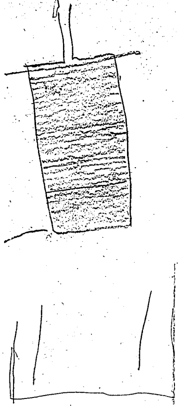
Motor No. 2.

Menlo Park Notebook #10 [N-78-12-16]

This notebook covers the period December 1878-January 1879. Most of the entries are by Francis Upton. There are also entries by Edison and Charles Batchelor. Some entries have been signed by Edison. Almost all of the material relates to experiments on electric lighting. Included are calculations by Upton about generators and electric distribution systems, with a few calculations by Edison; notes and drawings of lamps; and notes and drawings of generators. There are also notes by Upton on miscellaneous subjects, from etheric force, electricity, magnetism, and phosphorescence to light and heat. Similar notes can be found in Menlo Park Notebook #15. The book contains 282 numbered pages.

Blank pages not filmed: 88-89, 198-201, 280-281.

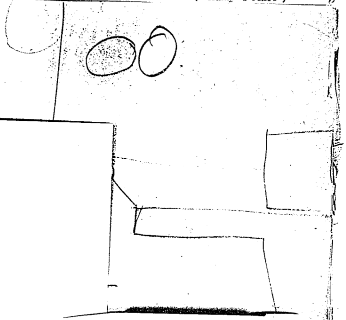
No 10



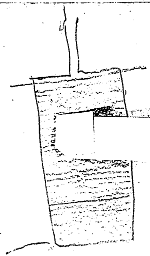
50
1.0
500

500

Pages 1 to 16."Incandescent Lamp Calculations".
(Unimportant)

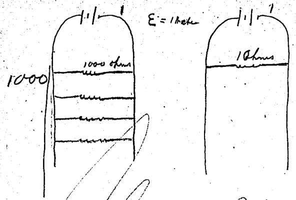


No 10



50
10
500

500



$\mathcal{E} = 1$

Heat $= R\,C^2$

$C = \frac{\mathcal{E}}{R+r}$

$\frac{1}{1000} +$

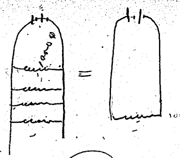
$\mathcal{E} = \frac{1}{1+\frac{1}{1000}} = \cancel{1000}$

$r = 1$

$\mathcal{E} = 1 \quad C = X \quad R = 1000$

$C = \frac{\mathcal{E}}{1+1000}$

Heat $= \frac{\mathcal{E}^2}{1001^2}\ 1000$



100 lamps 1 ohm each.

$$Heat = R C^2$$

$$C = \frac{E}{R+r}$$

$E = 2$

$R = \cancel{10} = 1$

$r = 1$

$$100 \overline{)10000} \quad 100$$

$$100 \overline{)1000} \quad 10$$

10,000.

1	1000
2	500
4	250
8	125
16	62 1/2
32	31 .25
64	15 .62

$V \quad \frac{1}{1000}$

$\frac{1}{10000} \; 10000 = 1$

$1 = \frac{1}{100} = \frac{1}{1000}$

$\frac{1}{10000} \times 10000 = 1$

$1.1 \quad \cancel{\frac{1}{100}}$

$C = \frac{E}{\frac{x}{100}+1} = \frac{1}{\frac{x}{100}+1}$

$Heat = \frac{1}{\frac{x}{100}+1} \cdot \frac{1}{\frac{x}{100}+1} \cdot X$

$\frac{X}{\frac{x^2}{10000}+\frac{2x}{100}+1} = \frac{1}{10101}$

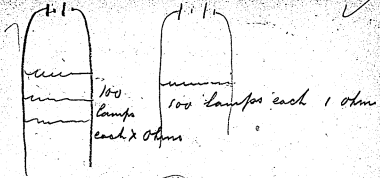
$10101\,x = \frac{x^2}{10000} + \frac{2x}{100} + 1$

$1010100000 = x^2 + 200x + 10000$

$x^2 - 1010{,}10000 = 10000$

$x^2 - 101010000$

50000000



$E = 1 \qquad Heat = C^2 R$

$R = 100 \qquad R = 100 \qquad C = \frac{E}{R+r}$

$r = 1$

100

$C = \frac{E}{1+100} = \frac{1}{101}$

$Heat = \frac{1}{101} \times \frac{1}{101} \times 1$

$= \frac{1}{10101}$

$Heat = \frac{E}{1+}$

$x - 5000000 =$

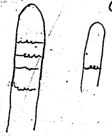
$\frac{1}{1000}$ $\frac{1}{1}$

$1000 \times \frac{1}{100000} = \frac{1}{100}$

$\frac{1}{100} \cdot 1 = \frac{1}{100}$

Heat $= C^2R$

C in whole $= 1$



1 oz. Zn. per lamp

10000 in each

$\frac{10000}{100} = 100$ Ohms in all

$\frac{1}{100}$ of current in each

$\left(\frac{1}{100}\right)^2 = \frac{1}{10000}$

$\frac{1}{10000} \cdot 10000 = 1$ Heat in each lamp

---

100 Ohms in all
1 Ohm in each lamp
1 Current in each lamp
$1 = 1 \times 1$. Heat in each lamp

Heat = ~~$\frac{\mathcal{E}}{R}$~~

$C = \frac{\mathcal{E}}{R}$

Heat = $\frac{\mathcal{E}^3}{R}$

Heat = $C^2 R$

1 oz

100

100 100

100 100 $C = \frac{1}{2}$

$C = \frac{100}{100+100} = \frac{1}{2}$

$C = \frac{\mathcal{E}}{2R}$

1 oz.

$C = \frac{\mathcal{E}}{R+r}$

$C = \frac{1}{1+1} = \frac{1}{2}$

$C = \frac{2}{1+2} = \frac{2}{3}$

$\frac{4}{3}$ oz. ~~1 oz $\frac{4}{3}$ oz~~ $1\frac{2}{3}$

$1\frac{1}{3}$ $H_1 = 1\frac{1}{3}$ $1\frac{1}{3}$

$1\frac{1}{3}$ $1\frac{1}{3}$

100 X 100

$C = \frac{1}{2}$

Page 235-217

$C^2 R$

$$C = \frac{\mathcal{E}}{R}$$

$$C^2 R =$$

$$\frac{\mathcal{E}^2}{R^2} R = \frac{\mathcal{E}^2}{R}$$

$$C^2 R = \frac{\mathcal{E}^2}{R} \qquad \mathcal{E}$$

$C^2 R$

$$C = \frac{\mathcal{E}}{R}$$

$$\frac{1}{4} \cdot 2 = \frac{1}{2}$$

$$\frac{2}{3} \cdot 3 =$$

$$\frac{4}{9} \cdot 3 = \frac{4}{3}$$

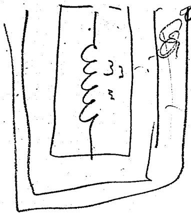
$$\frac{2}{3}$$

$1 \quad \frac{8}{3}$

$1 \quad 2\frac{2}{3}$

Joule

1842



1000

$C = \frac{1}{1001}$

$\frac{1}{(1001)^2} \cdot 1001$

Hard

$\frac{1}{1001}$

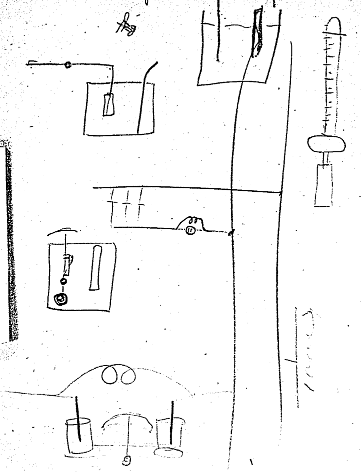
12 H
3
36
60
2.160

$C = \frac{2}{1002}$

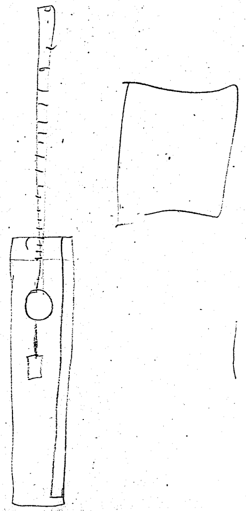
$\frac{4}{(1002)^2} \cdot 1002$

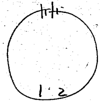
$\frac{4}{1002}$ $\frac{1}{250}$

Electric light — Metres Dec 20 17



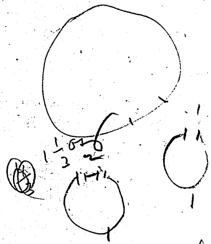
Scale for measuring





$$\mathcal{E} = \frac{1}{1+1} = \frac{1}{2}$$

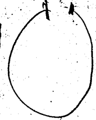
$$C = \frac{2}{2+2} = \frac{1}{2}$$



$$C = \frac{1}{1+1} = \frac{1}{2}$$ Veber

$$C = \frac{2}{2+1} = \frac{2}{3}$$

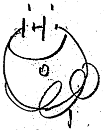
$r = 1$ $\quad \mathcal{E} = 1$



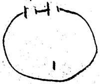
$$C = \frac{\mathcal{E}}{R+r}$$

$R = 1$

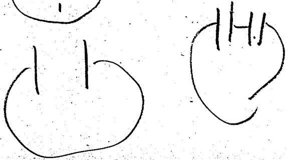
$$C = \frac{1}{1+1} = \frac{1}{2}$$



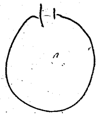
$$C = \frac{2}{2} = 1$$



$$C = \frac{2}{2+1} = \frac{2}{3}$$



1



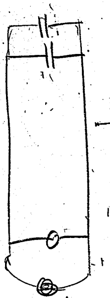
$= 1$

1

$$C = \frac{1}{\frac{1}{2}+1} = \frac{1}{\frac{3}{2}} = \frac{2}{3}$$

$1\frac{1}{3}$

$110 - 100 = 10$



110°

12 inches long

1

100,

110°

200°

1 ohm

110°

$\frac{1}{10}$

2 mile $\frac{1}{4}$ = 20 km

$\frac{1}{10000}$ ① = 20

$\frac{1}{20000}$ $\frac{1}{1.6}$

$\frac{\pi D^2}{4}$

$\frac{\pi D^2}{4} \frac{1}{2000}$

16)20000(1250
16
40
32
80
80

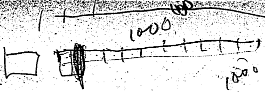
$\frac{1}{10000}$

$\frac{\pi D^2}{4} = A$

$\frac{\pi D^2}{4} = 20000$ $\frac{1}{20000}$

1250(3
4
350

$\frac{1}{5000}$



10 inch 1000 2000

110

6
120

3
140

1/2
180

3/4
260

1000
1000
2000

20

40

110

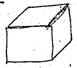
100

1/2

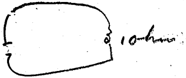
200
400

4000
2000
1000

30
15
7 1/2



$C = \frac{E}{R+r}$



$C = \frac{1}{1+1} = \frac{1}{2}$

$C = \frac{1}{\frac{1}{30}+1} = \frac{30}{31}$

1 2

2 horse power Dec 16 27

Cu. rod $\frac{1}{4}$ in diametre

Length 30 inches

~~1644~~

.1654

1000

12000 : 30 :: .1654

4000 ~~66.1600~~

400) .1654

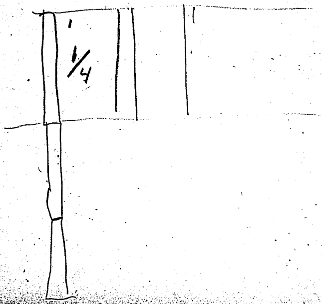
00.04135

10004

.0004

$$\frac{413}{10000} = \frac{1}{2500}$$

$$\frac{1}{2500} \qquad 1000^{0}$$



12000 : 30 :: .1654 :

400 : 1 :: .1654

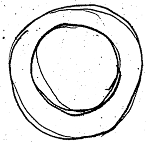
$$\frac{.1654}{400} = \frac{.001654}{4}$$

.000413 Ohm

$$\begin{array}{r} 6046,5 \\ 12 \\ \hline 120930 \\ 60465 \\ \hline 72558. \end{array}$$

72558 : 30 :: 1 ,

$\frac{1}{2500}$ ohm



$\frac{1}{4}$

12 ~~8 inches~~

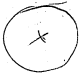
$\left(\frac{1}{4}\right)^2 = \frac{1}{\cancel{8}6}$

$\frac{12}{16} = \frac{3}{4}$

$\left(\frac{1}{4}\right)^2 \pi$ $\frac{1}{16}$

$\frac{1}{12}(X)^2 \pi$

$\frac{12}{16} = \frac{3}{4}$



$\frac{\pi D}{4} = A$

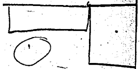
$D = \frac{4}{\pi} A$

$= \frac{\cancel{4}}{\cancel{\pi}} \frac{3\cancel{\pi}}{\cancel{16}} = \frac{3}{4}$

3

$\frac{3}{4}$ $\frac{9}{16} \times \frac{1}{12} =$

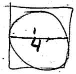
$\left(\frac{9}{16}\right.$ $\left(\frac{3}{4}\right)^2$



$\frac{1}{4}$ 12

$\frac{1}{16}$ 12 area

$\frac{12}{16} =$ $\sqrt{\frac{3}{4}}$



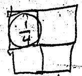
$\frac{1}{16}$ $\left(\frac{12}{16}\pi\right)$

$2\pi R$

$\pi R^2 = \pi \frac{D^2}{4}$

$\frac{1}{16}$ $\frac{1}{8}$ $\frac{1}{64}$ $\frac{3\pi}{16}$ $R = \frac{D}{2}$ $R^2 = \frac{D^2}{4}$

$\frac{12\pi}{64} = \frac{3\pi}{16}$



$\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{16}$

$\frac{1}{8}$

$\frac{\pi D^2}{4}$ $\frac{1}{64}\pi$

64)3.1415(.049 .049
256
581
512

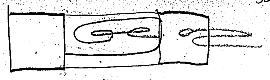
56 Ends

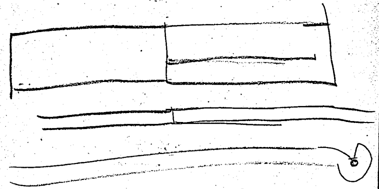
$\frac{1}{4}$

64) 2 .49

$\frac{1}{.05}$

$\frac{5}{100}$ $\frac{1}{20}$





960 Lamps 960 Lamps

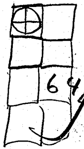
480°

160
64)320.0(5
320

$\frac{1}{4}$

$\frac{\pi D^2}{4}$ $\frac{\pi \frac{1}{16}}{4}$

L.



$\pi \frac{1}{64}$

$64 \overline{)3.1415}(.04$

$\frac{5}{100}$

$\frac{1}{20}$ $\frac{60}{20} = 3$ inches

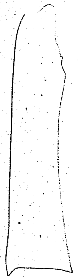
30

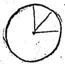
$4 \overline{)3.14\cancel{16}}$

$.785$

30

$\overline{23.550}$





2,355

23,55

3.

7

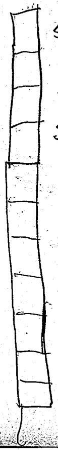
$\frac{3}{4}$

$26. \frac{1}{2}$

$23. \frac{1}{2}$

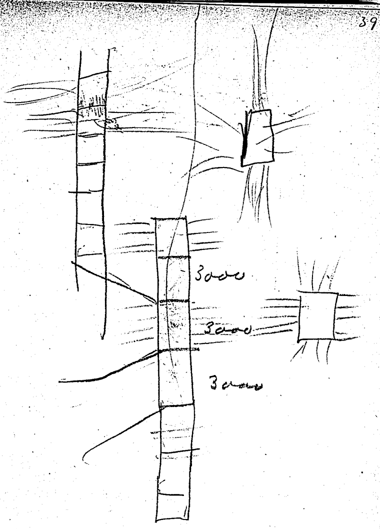
$\frac{3}{5}$ 5.4

$$\cancel{27)\,5.4\,(2}$$
$$\cancel{5\;8}$$



$$5.4)\,250\,(4$$
$$\underline{216}$$
$$44$$

$$5.4)\,270\,(5$$

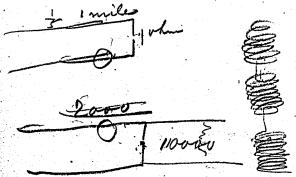


10000

2500

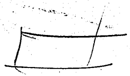
1000 2000

2000 2000



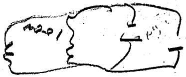
Light

1 H.P.



$$\mathcal{E} = \frac{E}{R+r}$$

6640



1/2

2700°

10000

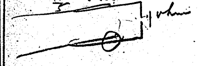
2500

1000 2000

2000 2000

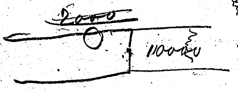
$\frac{1}{3}$ 1 miles

1 ohm



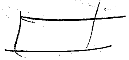
2000

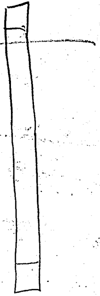
1100 Ω



Light

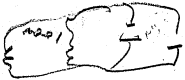
1 H.P.





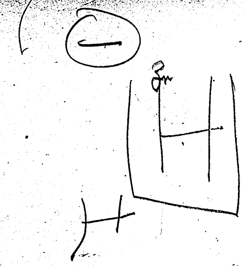
$$\mathcal{E} = \frac{E}{R+r}$$

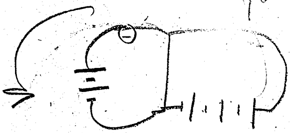
6640



2 T

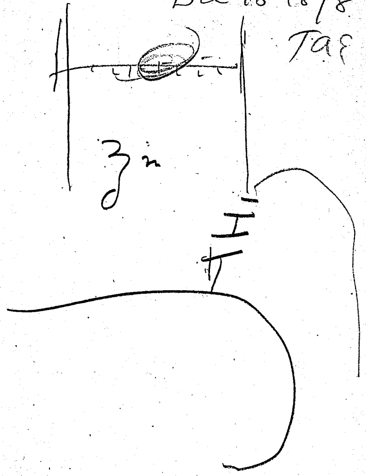
0.0072





Dec 18 1878
TAE

Dec 18 1878
TAE



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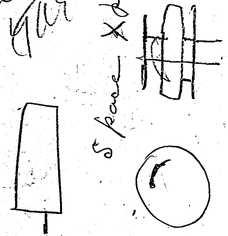
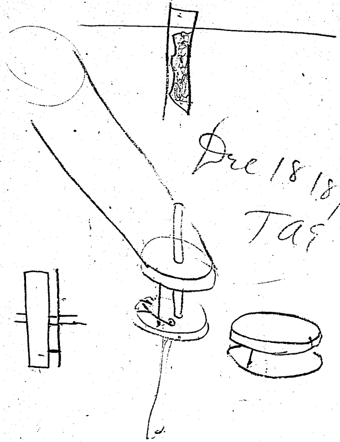
Space X pressure = work





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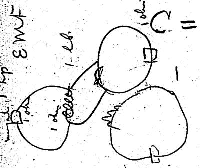
800 20
120 20

$$\frac{18}{6}\ \ 60$$

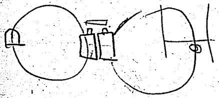
C R

$$C = \frac{E}{R}$$



$$1 = \frac{1}{1}$$

$$C = \frac{2}{1}$$



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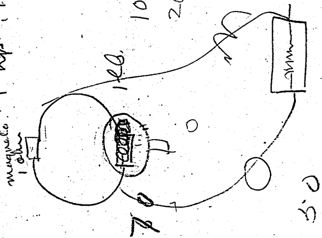
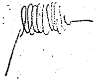
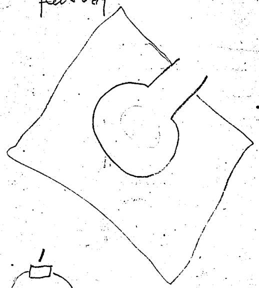
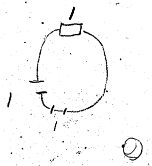
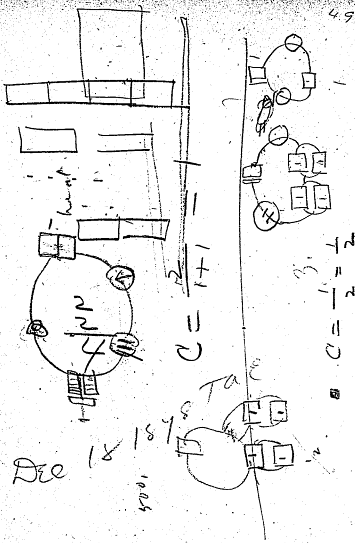
Dec 18 1878
TAE



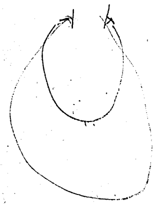




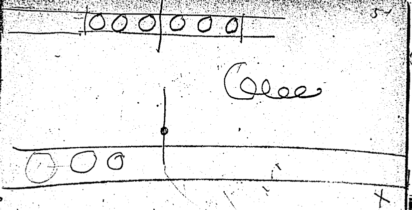


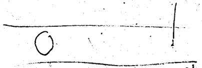


4



$$C = \frac{1000}{17.00}$$

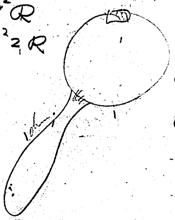




$$C = \frac{E}{R + r}$$

$$H = C^2 R$$

$$2H = C^2 2R$$



$$C = \frac{E}{R + r}$$

$$C = \frac{2E}{2R}$$

As. 4225 : 43561 :: 330

330

13068

13068

4225) 1437480 (340

12675

16998

16900

980

80

80

6400 : 43561 :: 340

340

17424

13068

8) 1481040

8) 1851

231 -

Dec 16 1918

4356 : 6400 : 340

340

256000

192

4356) 2176000 (500

217800

0

80

80

6400

12800

400

81 / 625

$G = .1$ Ohm

$C = 1.$ Ohm

$D = .2$ "

$r = .2$

$R = 1.3 + .528$

$= 1.828$

$$\mathcal{E} = \frac{E}{1.828 + .2} = \frac{E}{2.028}$$

$E = 2.028$

$C = 1$

14 5 3 4

$$\begin{array}{r} 75 \\ 8 \\ \hline 83 \end{array}$$

1 Equiv 2.248 10.503

10000

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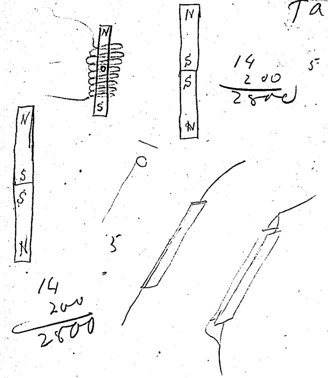
TAE



$$\begin{array}{r} 14 \\ 200 \\ \hline 2800 \end{array}$$

5

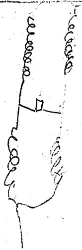
$$\begin{array}{r} 14 \\ 200 \\ \hline 2800 \end{array}$$

$\pi R^2 = A$

$\pi D = C$

$2\pi R \times \frac{1}{2} R = \pi R^2$

$$\begin{array}{r} 5236 \\ 6 \\ \hline 3.1416 \end{array}$$



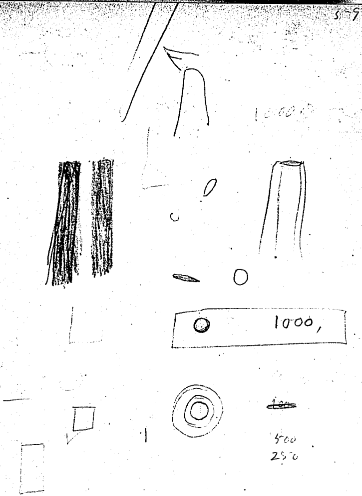
$\frac{1}{6} \pi D^3$

$3/16$

$4 \pi R^2$

πD^2

$\frac{1}{6} (\pi D^2) D$



$\frac{3}{16}$ 16) 3.0 (.183

16
140
134
60

2)(.183
.0911

16 ~~cts~~

.0911
.0911
911
819
.008281
3141
8281
331241
~~248433~~
8281
248433
.02601~~6621~~

πr^2

$4\pi R^2$

.026 10

.026
~~.10~~4
1.04

~~1000~~° ~~1000~~
~~200~~ ~~250~~
~~200~~ 25

$\frac{3}{16}$ $(\ )^2\pi = A$

$\left(\frac{3}{16}\right)^2\pi = A$

$\frac{9}{256}\pi = A$

9

16
16
96
16
256

3.1418
9
256) 28.2744 (.11
256
267
256
11 4

$\frac{1}{10}$ inch

$\frac{1}{10}$ inch 1000°. 5000°

1 inch 100°. 500°

82°

$\frac{1}{12}$ 60000

12

720,000

15

3,600,000

72

10,800,000,000

~~per mm~~

2 3

11 000 000

783,3 00.

$\frac{5}{12}$

5 ft

14)3600

1200

1000

15

60

~~10000~~

30000

~~2/60000~~

~~1000~~

60.000

3.40

15

$\frac{5}{12}$

2 lbs

$\frac{1}{30}$ lt

$$1{,}120)\,196000\,(176.$$
1120
84000
7840
6600

1760

1.120
90

Dec 18 1878
TAE

10000

10000

2200
40

Cr 1 Ton Coal

destroyed
1340
from one ton 1300 destroyed to make 10000 cuft gas
1300lbs = 10000 ft of gas one hour
5

5 / 10000
2000 = Gas burners for one hour
= 30000 candles

1300
2

2 / 1300
650

Dec 18 1878
TAE

650) 30000 (4
2600
4000

650
600 candles Jablochkoff
390000
13

$$\begin{array}{r} 650 \\ 6 \\ \hline 3900 \end{array} \qquad \begin{array}{r} 650 \\ 90 \\ \hline 58500 \end{array}$$

650 Horse power

6 lamps per horse.

6 X 15 candles " " = 90

$$\begin{array}{r} 650 \\ 90 \\ \hline 58.500 \end{array}$$

58.500 candles for 1300 lbs of coal

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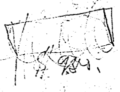
Thi



772) 33000 (42
3088
2120
4

1.

$$\begin{array}{r} 355 \\ 42 \\ \hline \end{array}$$

Dec 18 1878
.0355
Thi

,0355

$$\begin{array}{r} 33. \\ 42 \\ \hline 66 \\ 132 \\ \hline 1386. \end{array}$$

1386 lbs of Pt. heated in one

1386 degrees Fahr. 1 degree.

50	28	19
34	91	16
55	76	13
139	195	48

67	40
46	46
38	40
151	126

Dec 18 1878

Jag

$$C = \frac{8}{3+2} = \frac{8}{5}$$

$$Heat = C^2 R = 7.7$$

$$\left(\frac{8}{5}\right)^2 3 = \frac{64}{25} 3$$

$$25 \overline{)192} (7.7$$
$$\underline{175}$$
$$170$$

Heat = 7.7

$$C = \frac{8}{2+6} = \frac{8}{8} = 1$$

$$Heat = C^2 R = 1 \cdot 6 = 6$$

Heat = 6.–

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Battery 2 Ohms
Lamp 3 Ohms
Electromotor 8

$\frac{1}{4}$ inch radiating surface

2
1.6

Battery 2 Ohms
Lamp 6 "
E 8
$\frac{1}{4}$ in radiating surface

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Dec 18 1878

TAE

Lamp = 6

$$C = \frac{8}{1.6 + 6} = \frac{8}{7.6}$$

7.6) 8.0 (1.05
7.6
400

1.05
1.05
525
105
1.10
6
6.60 = Heat

Battery 1.6
Lamp 3.0
E.F. 8

Not 1

1/4 in

Dec 18 1878

TAE

Lamp 6

$$C = \frac{8}{3 + 1.6} = \frac{8}{4.6}$$

4.6) 8.0 (1.74
4.6
340
322
180

1.74
1.74
696
1218
174
3.0576
3 0
9.15 08 = Heat

9.15

No 1

$$C = \frac{\mathcal{E}}{R+r}$$

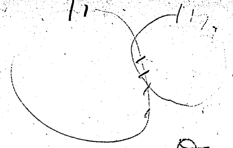
$$C = \frac{2\mathcal{E}}{R'+2r}$$

$$\frac{\mathcal{E}}{R+r} = \frac{2\mathcal{E}}{R'+2r}$$

$$R'+2r = 2R+2r$$

$$R' = 2R$$

$$C = \frac{\mathcal{E}}{\;}$$



Dec 18 1878

TAE

$$C = \frac{\mathcal{E}}{R+r}$$

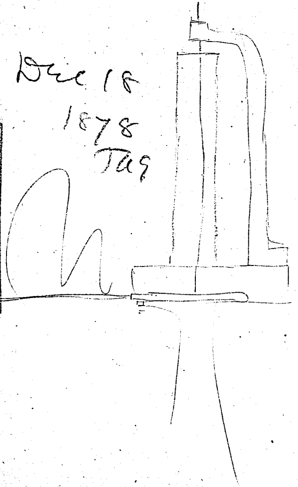
$$C = \frac{\mathcal{E}}{R'+\frac{r}{2}} = \frac{\mathcal{E}}{R+r}$$

$$R+r = R'+\frac{r}{2}$$

$$\frac{r}{2} = R'-R$$

$$r = 2(R'-R)$$

Dec 18
1878
TAE



Lamp with ~~6~~ in of $15/1000$
wire: with points 12 inch
long, ~~ta~~ Glass tube round
wire also a tube + 6" wire
for same

To record on glass run by
Wheatstone machine

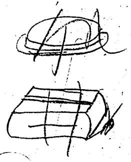
Small Key with bristle
for record

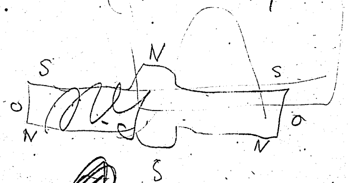
DEC 18 1878
TAE

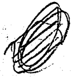
$$C = \frac{a}{R+r}$$

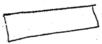
Dec 18 1878

Tr



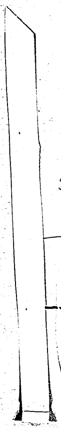


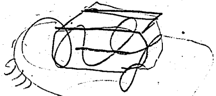


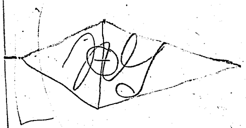


$$C = \frac{E}{R+r} = \frac{2E}{2(R+r)} = \frac{2E}{2R+2r}$$

$$2R + 2r = 2r$$







Dec 18

$$C = \frac{E}{R+r}$$

$$C' = \frac{E}{R'+r}$$

$$\frac{C}{R+r} = \frac{C'}{R'+r}$$

$$CR' + Cr = C'R + C'r$$

$$r = \frac{C'R - CR'}{C - C'}$$

$$C = \frac{E}{R+r} = \frac{E}{R'+\frac{r}{2}}$$

$$2R' + r = 2R + 2r$$

$$r = 2(R' - R)$$

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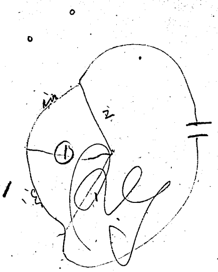
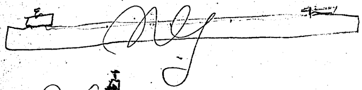
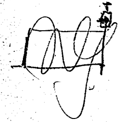
TAE







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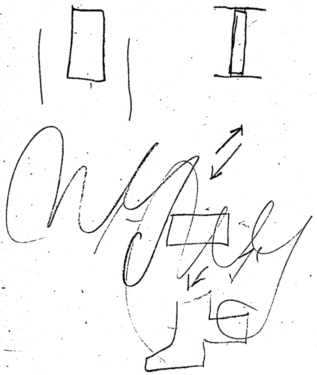
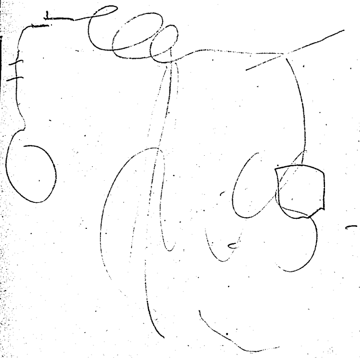
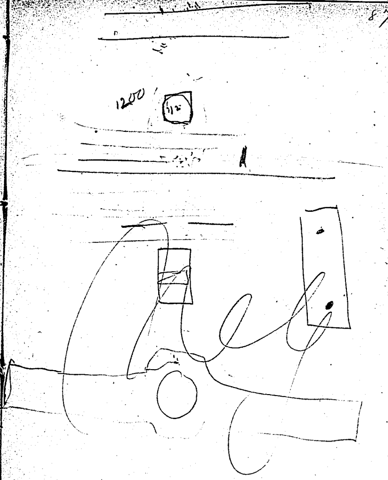


Dec 18 1878 TAE





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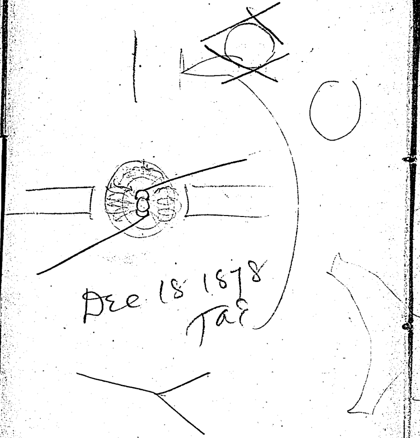
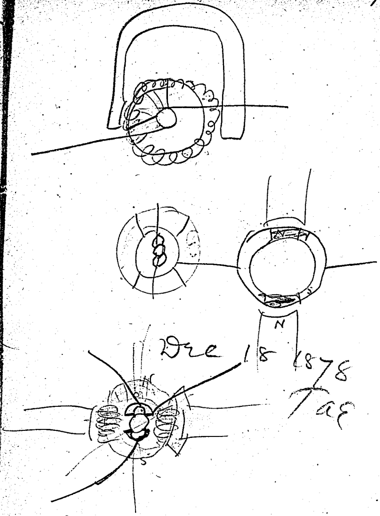
TAE



Dec 18 1878
Tae



Dec 18 1878
Tae

r = 10 Ohms

1 H.P. R = 10 Ohms

r = ~~8~~ Ohms R = 2 Ohms

$C = \frac{\mathcal{E}}{R+r} = 1$

$C^2 -$

DEC 18 1878 TAE

3.06	1.75
.10	1.75
30.06	875
	1225
	175
	3.0625

1 Cell of # r = 10 Ohms

1 " " r = 2 Ohms

10 Ohms outside

$\mathcal{E} = 20$

$C = \frac{20}{10+10} = \frac{1}{20} = 1$

$C = \frac{20}{10+2} = \frac{20}{12} = 1\tfrac{3}{4}$

DEC 18 1878 TAE

$C =$

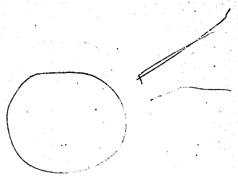
$1 \cdot 20 = 20 = 1$

$(1\tfrac{3}{4})^2 \cdot 12 = 36.72$

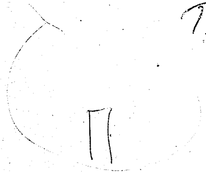
3.06 $1\tfrac{3}{4}$ $\frac{36}{20}$

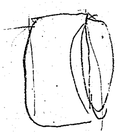
.12

36.72



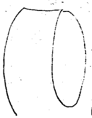
Dec ~~22~~ 18 1878
TAE





Arms for cooling

Dec 18
1878 TAE



in the hand

No force of gravitation = condition of matter

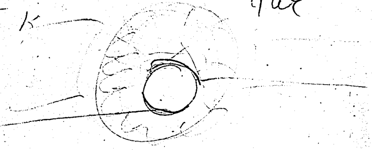
 Gramme

Cut down useless resistance

Bigger wire
Cold

Dec 18 78
TAE

K



Iron very rare no knowledge of Elec.

10
8   2   10

$C = \frac{8\ 1}{2+10} = \frac{1}{12}$

10   Dec 18/1878
TAE

10 Ohm machine
10 " outside
1 H.P.
Effect $\frac{200}{100}$ calories in all

10
2

$12C^2 = 200$

$C^2 =$

12)200(166
12
80
72
80
166
34

$$\text{Heat} = C^2 R$$

$$(10+10) = 20$$

$$\overline{20+20}$$

$$\frac{1}{10+10} = \frac{1}{20}$$

$$\frac{1}{400} \times 20 = \frac{1}{20} \text{ Heat}$$

$$\frac{2}{20+20} = \frac{1}{20} \quad 2 \text{ H.P.}$$

$$\frac{1}{400} \times 40 = \frac{1}{10} \text{ Heat}$$

$$C = \frac{E}{R} = \frac{2E}{2R}$$

Dec 18 1878

T.A.E.

Electric Light   Dec 18th 1878 [illegible]

Chas Batchelor

Small Gramme Machine from Princeton heats a Platinum wire to dull red (only just see it) } $22\frac{5}{8}$ inch long

11 cells Conrod + H large battery (pretty well played out) } is exactly equal to it

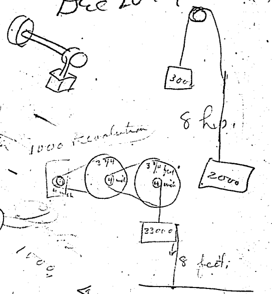
Size of Platinum wire ~~[illegible]~~ ·01
Length —— 22 5/8 inches
Resistance —— 2·3 ohms

11 cells made new heat $35\frac{1}{4}$ in wire of 3·47 ohms

8 cells = the Gramme

Bell telephone with Cu

Dec 20 1878 TAE



1000

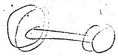
Boston

125
250
750
250
33000
33000

4
5

Boston
Boston
Boston
Boston
Boston

8 1000
1. 125 8 inch
2000 feet



150.
15 2
7 1/2 4
3 3/4 .8 60

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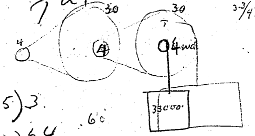
TAE



125)3.
264 .60

1. 90
90
8100

20
60
1200

33
33
99
99
1089

32
32
64
96
1024

90

33000 (132
250
800
750
500

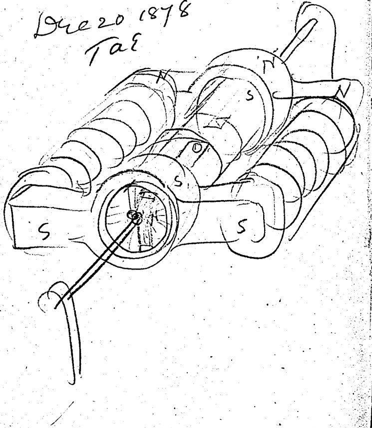
20
20
400

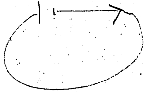
30
30
900

Resistance with wire

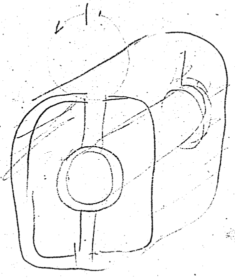
.9 Ohm

Dec 20 1878
TAE





Dec 20
1878 TAE



66 Cells per minute

5.5 : 9 :: 90
9
5.5)810 (14
55
260
220
400

Dec 20 1878 TAE

0 0 0 0

12

14000,

7
24 . 21,

Gramme Mach with 100 ohms resistance

90 turns per min 5.5

~~204 " " "~~ ~~11~~

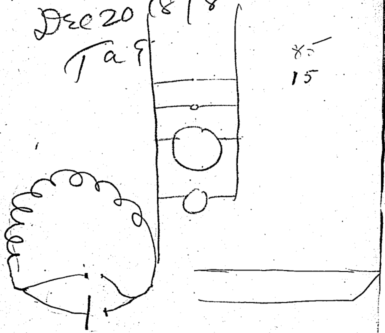
~~75 L~~ ~~9~~

11.5

180

Dec 20 1878 TAE

85
15



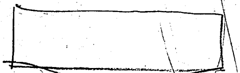
85

13

$15\overline{)85}(5.6$

75

100



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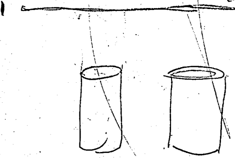


$\frac{1}{100}$ $\frac{1}{\text{ohm}}$

Heat or Temperature $= C^2R$

Wanted Heat = 1 unit

$(10^2) \times \frac{1}{100} = 1$

C = 10

$\frac{1}{1000}$ Ohm

a = 10

Current = 10

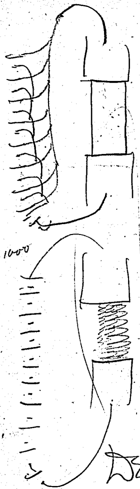
Wanted heat = 1

1 1 = 1

1 Ohm

~~Ohm~~

Current = 1



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TAE

Heat =

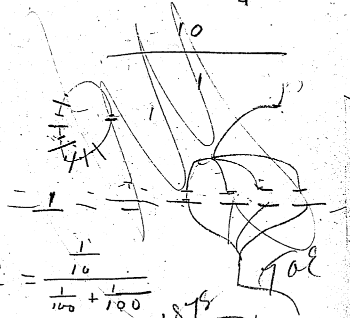
~~100~~

Current ~~100~~

$\frac{1}{100}$ ohm

1

Current 1 =



$$C = \frac{\frac{1}{10}}{\frac{1}{100} + \frac{1}{100}}$$

Dec 20 1878

$\frac{1}{10}$ C $\frac{1}{10}$ $\frac{1}{1}$

TAE

$C = 100$

Ex. To heat thick bar

$\frac{1}{1000}$ of Ohm Battery

Machine

Better to use an intensity machine than a quantity machine to make intensity?!

Battery nothing

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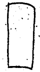
TAE

Heat = 1

Current = 100



$\frac{1}{100000}$

Current = 1

Heat = 1

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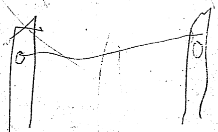
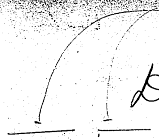
$$100 = \frac{1}{\frac{1}{10000} + \frac{1}{100}}$$

$\frac{1}{100}$ $\frac{1}{99}$ $\frac{1}{100}$





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Etheric force

If it were electricity of high tension there would be very small heating effects for even large sparks. This force will ~~cause~~ cause iron to scintillate when the connection is made across ~~the~~ a file.

When a magnet is made and remade the whole air around it is placed in a diamagnetic condition

that is force has been exerted to bring it, thus when

Dec 20 1878
TAE

Relays made short so as to prevent induction answer much quicker

Cost per horse power 1 ct per hour ($8/10$)

3.65
.10 hours a day
36.50
10 horse power to a machine
365.00 interest 10%

$\boxed{3650.00}$ $3.65 per year 36.50

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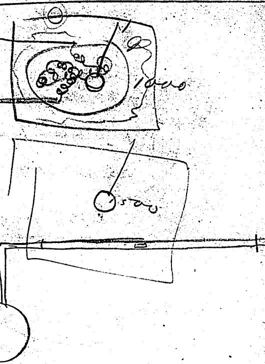
1500

$\frac{4}{10}$ 1500



1 HP

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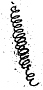

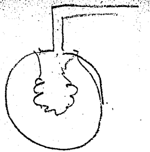

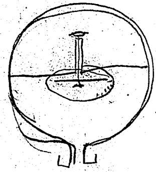

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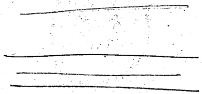
1878
TAE



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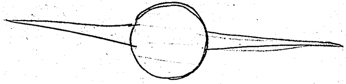

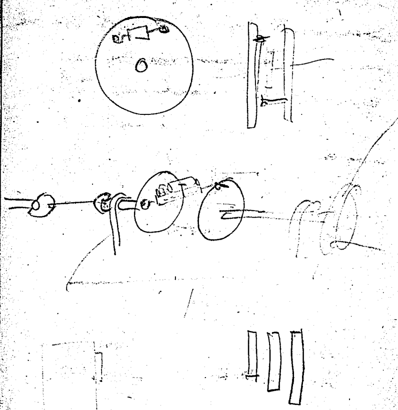

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Useless friction, as in the commutator, is much worse in a ~~tension machine~~ quantity machine than in a tension machine

Owing to dif % of loss

Machine 100 Ohm
Commutator 1 "

1% loss

Machine 1 100% loss
Commutator 1 " of the total

Dec 20 1878
TAE

Wire brush commutators used to prevent dangerly vibrations. This could be effected with rod combined with rubber

Current is proportional to the weakest field magnet. The same as in induction currents

If ~~the~~ the magnets vary the friction will be increased to run the machine at a higher rate.

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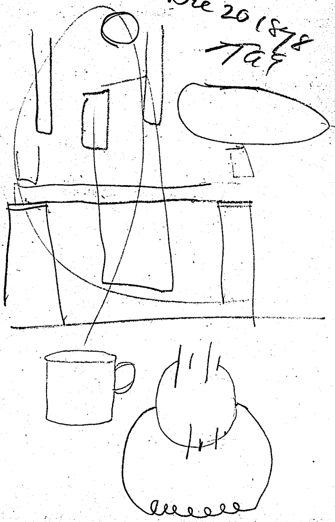
Dec 20 1878
TAE



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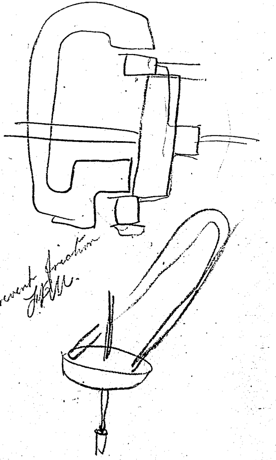
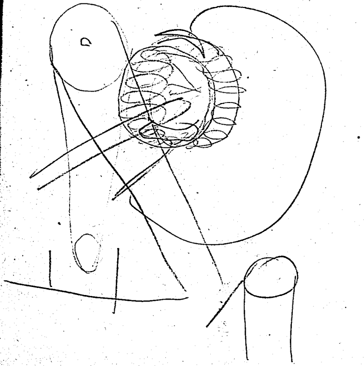


To prevent friction
JFKM.

1/100
Dec 20 1878 TAE



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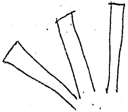
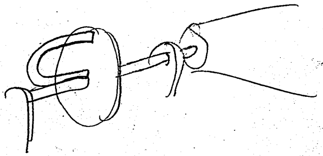
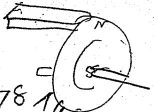
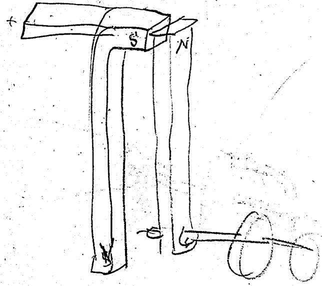






Dec 27 1878 TAE



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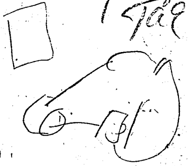
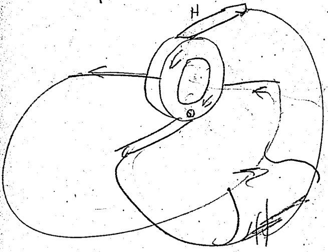


100



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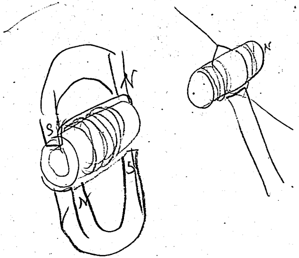
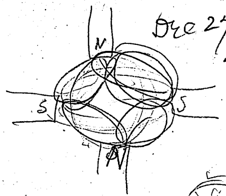
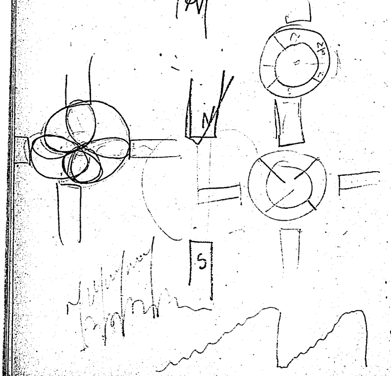


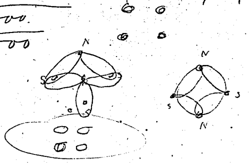
Dec 27 1878
T.A.E

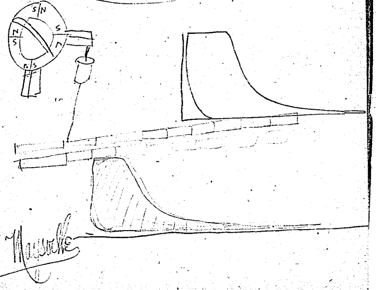




$$
\begin{array}{r}
3{,}145 \\
6 \\
\hline
18.870 \\
1000 \\
\hline
12 \overline{)\,18000} \\
\hline
1500
\end{array}
$$

Dec. 27 1878
TAE



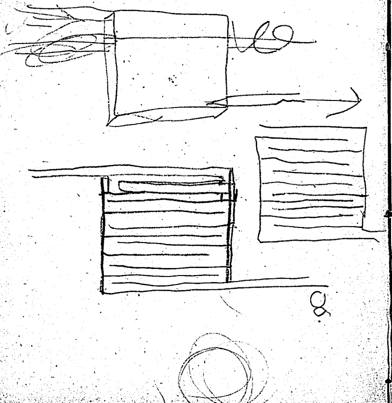


Heat trammeable

Elec " Dec 27 1878

TAE

Elec air tarn round iron



Dec 27 1878

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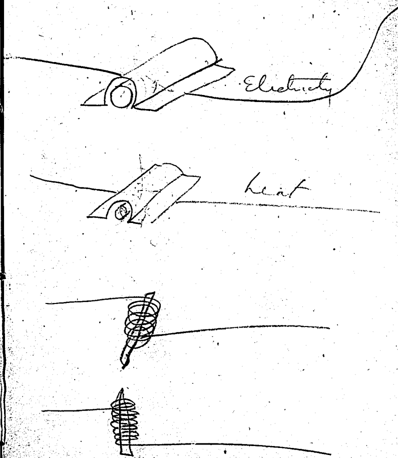

Coil 100 ~~feet~~

Diameter pipe 3 inches

C Dec 27 1878
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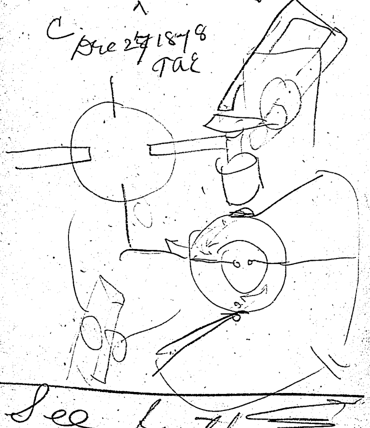

See further

1. Resistance of bobbin H R
2. Proportion of field magnet to bobbin H M
3. Exterior resistance W
4. Total heat in machine H
5. Total heat in ~~field~~ outside W
6. Heat in field magnet due to close coiling H. M
TAE Dec 27 1878
7. Heat in ring bobbins due to coiling. H. R Cause. Small radiating surface Prevention Rotation and bringing air currents to the coils
8. Heat by demagnitazation of the core H. R
9. Heat given off when quiescent in out of field H. R
10 C Resistance of commutators
11. Heat in field magnets H. M due to the passage of variable magnets across

Dec 27 1878
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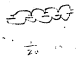
10 Current

$\frac{1}{100}$

10



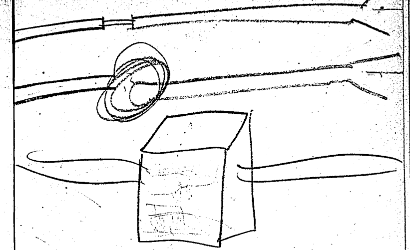
$\frac{1}{1+1}$

$$1 = \cfrac{\cfrac{1}{\cfrac{\frac{1}{10}}{\frac{1}{10000}}}}{\frac{1}{10000}}$$

1000 Cells

$$C = \frac{\frac{1}{10}}{\frac{1}{10000} + \frac{1}{10000}} = 500$$

1000 local action



Dec 28 1878
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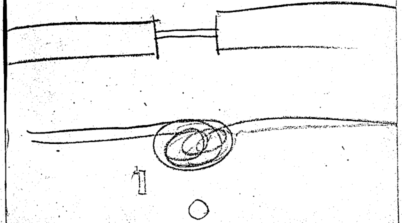

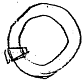

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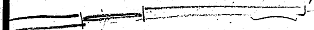
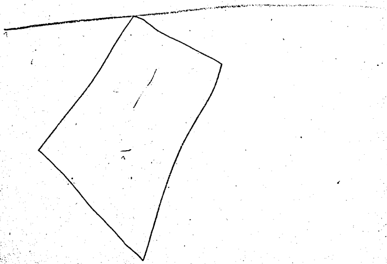


95. 5. 10



162 Light Dec 28 1878 TAE

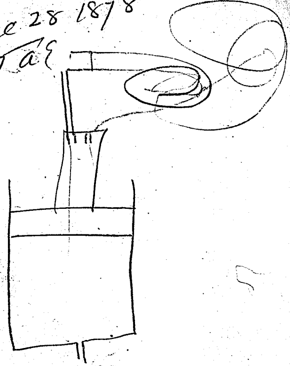
If it were not for the eye, it could not have been detected by any known reaction, except the decomposition of a few salts and a slight indication on the Thermopile. Suppose the race were blind to ~~heat~~ light as they are to Chemical rays ~~it would have~~ and had eyes which only measured heat rays, it would have probably been many years before the light would have been missed on the doctrine of the conservation of Energy. For example only $\frac{1}{1000}$ of the Energy of a gas Flame is given off in ~~m~~ light, and the experiments for

measuring the energy of a flame show more probable error than this.

Dec 28 1878
TAE 160

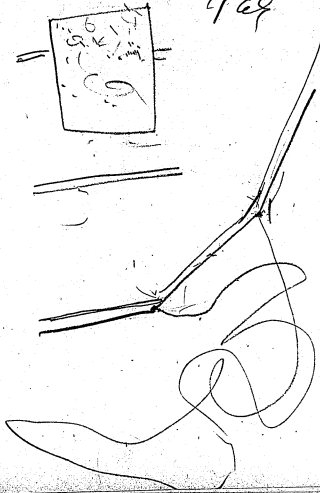
Dec 28 1878

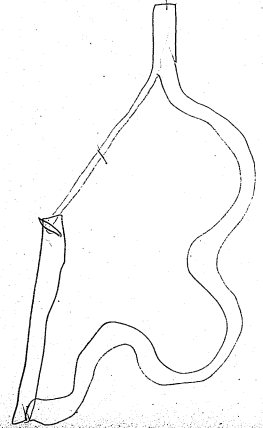
TAE



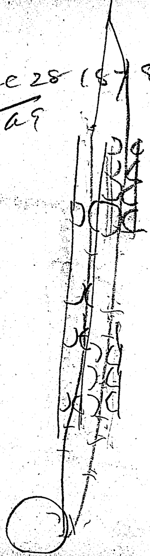
Dec 28 1878

TAE

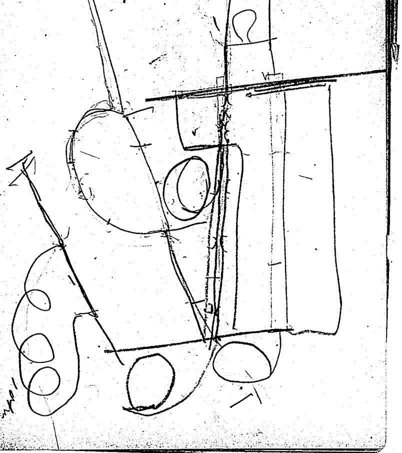




Dec 28 1878
TAE

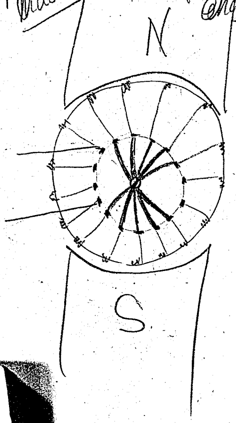


Dec 28
1878 TAE

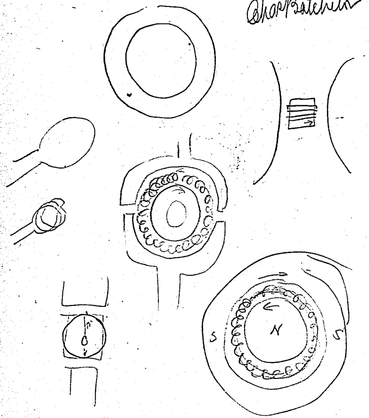


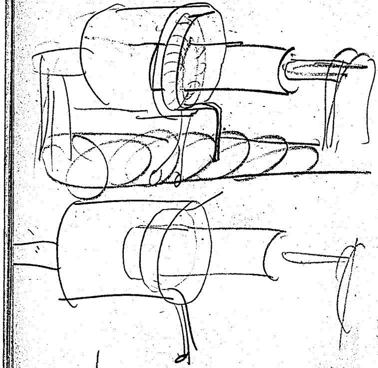
Magneto Electric Machine

Jan 1st 1878
Chas Batchelor



Dec 28 1878
TAE
Chas Batchelor





Dec 28 1878

TAE

Dec 28 1878

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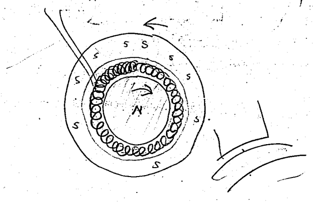

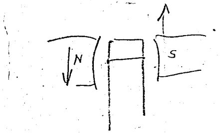

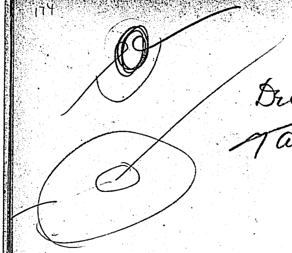

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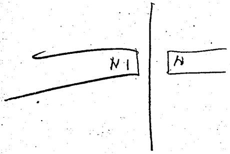
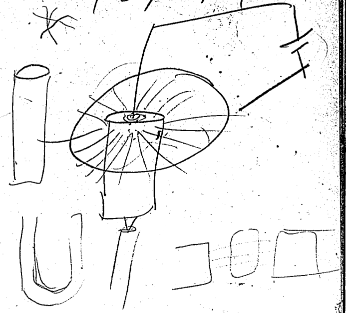
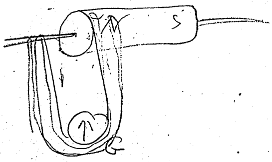


Dec 29 1878 TAE





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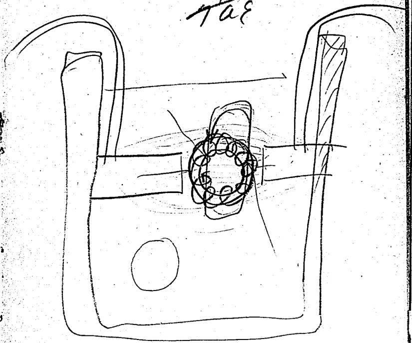
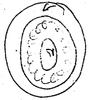
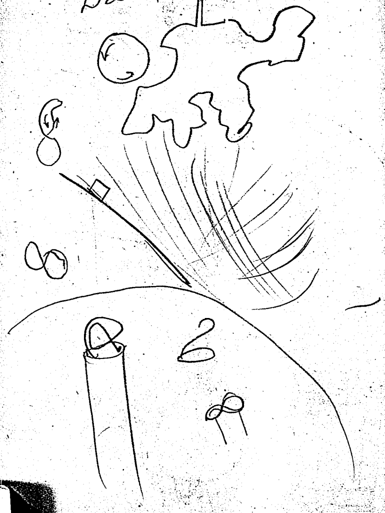
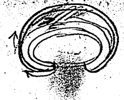




Dec 29 1878 TAE





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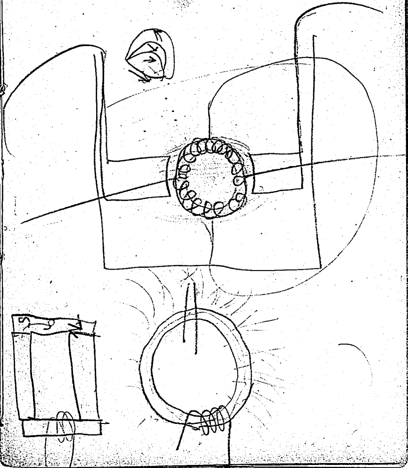

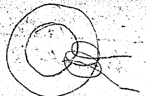

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Ex. Take a bar of steel hardened perfectly evenly carry a coil about one part for $\frac{1}{4}$ of the whole.** Pass a current and then break the the bar when it has ceased and see if there are poles.

** Better coil evenly entirely round and move the coil if possible

Dec 29 1878
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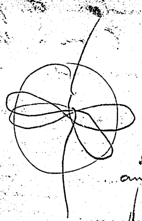
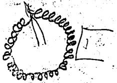
Would heat travel faster up or down ~~a~~ or the same

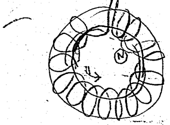
When a Bell telephone a motion is given to one diaphragm the other in answering will give a return current when it returns and so an echo as it were, will be made ~~and~~ a humming sound will result.

In clocks the pendulum will pick up earth currents and thus they will change their rates of movement if their direction is changed





This was also revolved in both poles and in one and no current.



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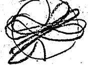
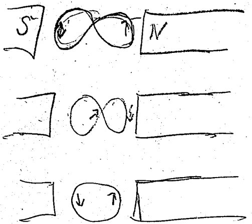
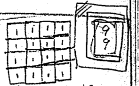
Wire wound in the form of a figure 8 on a wheel and revolved



No current





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TAE

Phosphorescence may be called the induction of light. The induction of Elec. means that a wire has had its matter put under a strain which when removed gives a current. So any substance when exposed to light absorbs it and when the light is removed gives it out as phosphorescence

Sun 65 or 70 miles only the distance of the atmosphere

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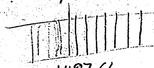
TAE

Dec 29 1878 TAE



Sun spectrum

1497 4

Line 14874 projects out of spectrum

When looking ~~through the~~ at the ~~refraction continuous spectr~~ spectroscope in as clear atmosphere, ~~the~~ Mr. E noticed that light streaks seemed to run across the spectrum. He noticed that a small cloud gave the same effect very strong and supposed that the phenomena was due to invisible vapor in the air

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1878
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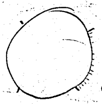
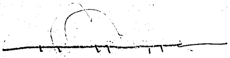


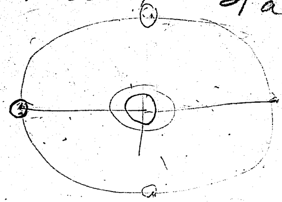
Diffraction
grating by rotation



182.000)

~~200000~~) 900000 (
60 |450
70

Dec 29 1878
TAE



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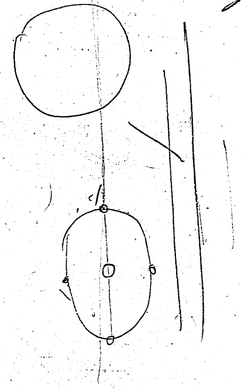

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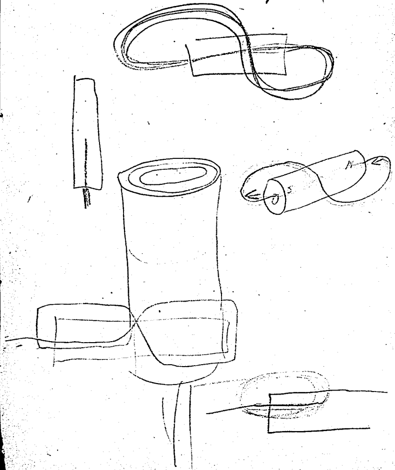

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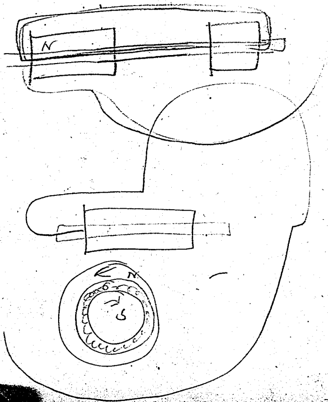
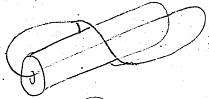
TAE

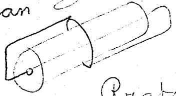


Dec 30 1878
TAE Portland
Portchester
Port Portland

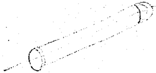


Por

Bostonian Protochloride



Protochlo

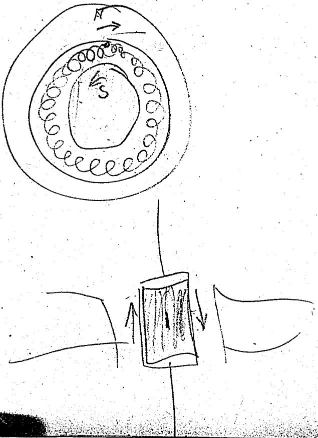


Protochloride

Boston

Dec 30 1878

TAE



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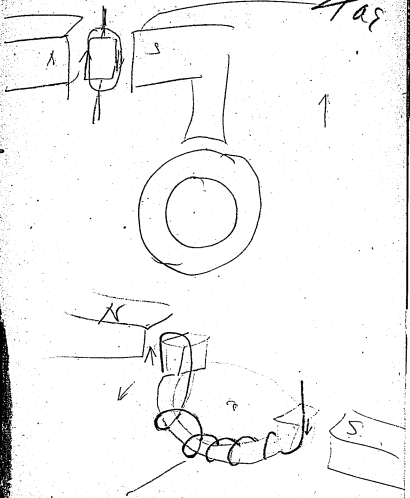

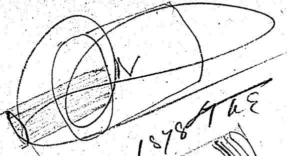

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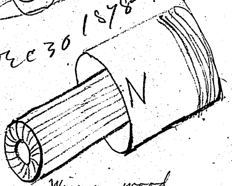

Wire on wood

Coil revolved and no current as it ought to be.

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1878
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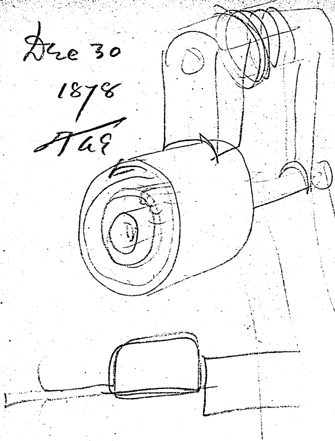

an electrometer may be considered as a galvanometer of great resistance. For example a 20.000 Ohm galvanometer will give indications exactly corresponding to the electromotive force of a battery. If we considered that we take a glavanometer which works with a resistance equal to the air leakage of a charged plate it must have a resistance to be counted by the ~~100000~~ hundreds of thousand of Ohms. All ordinary resistances would be ne-

glected in comparison.

The electromotive force is dependent on the chemical force existing between the substance and its exciting liquid or solid. The current depends on the number of molecules changing condition

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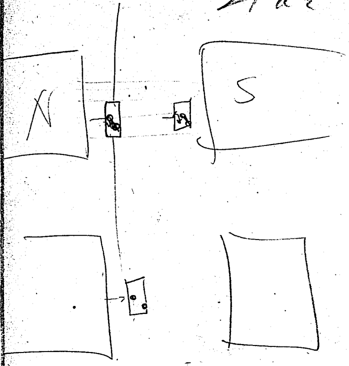

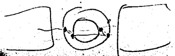

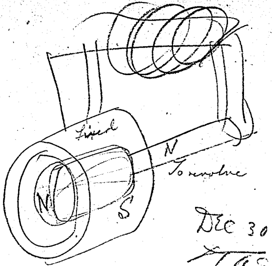

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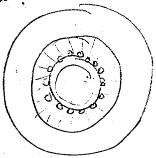
No current.



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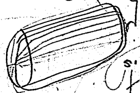
TAE

Francis Upton Esq Peabody Massachusetts

Upton

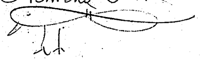
Upton Francis



Francis

Siemens alternic

Siemens Alternick



Dec 30 1878

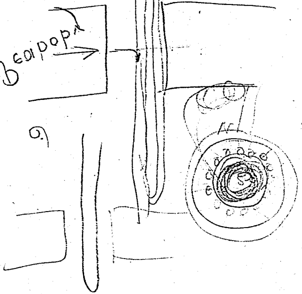
TAE

Francis

Francis Upton

Peabody

Peabody



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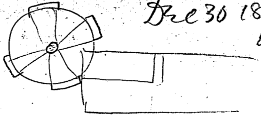

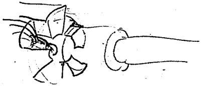

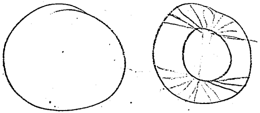

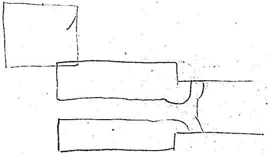

Dec 30 1878
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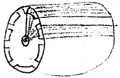

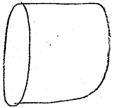

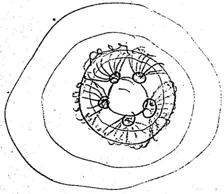

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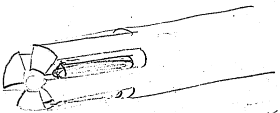

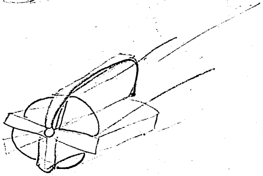

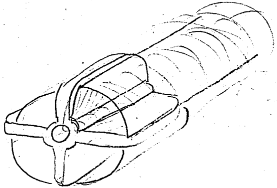

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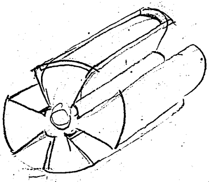

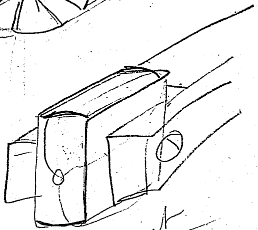

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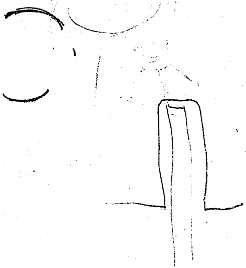

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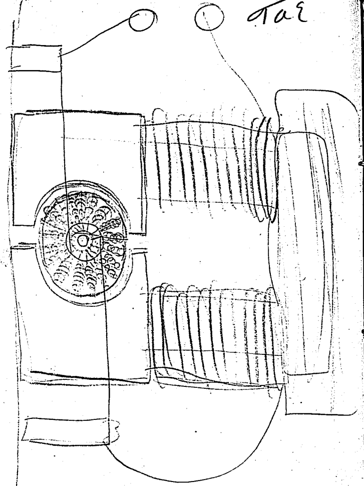

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Laboratory Note Book No. 10.

Pages 212 to 215.

Dynamo Machine.

See Edison Patent:

222,881

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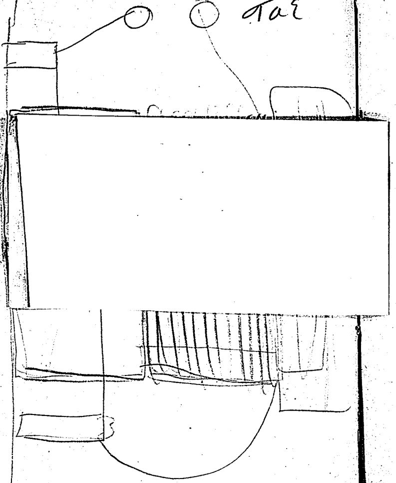

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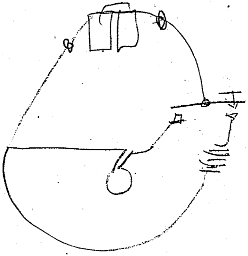

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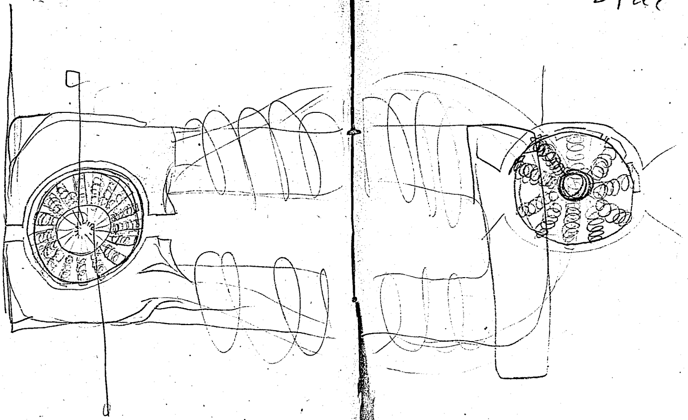

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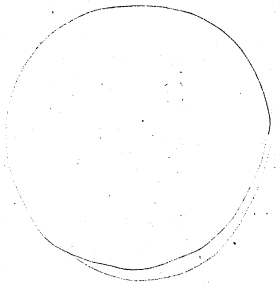

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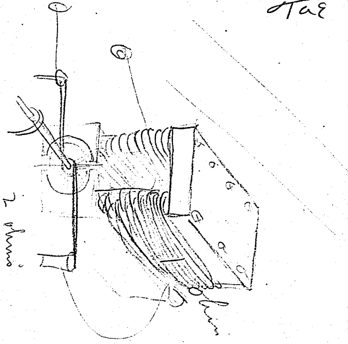
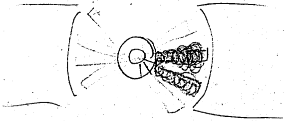
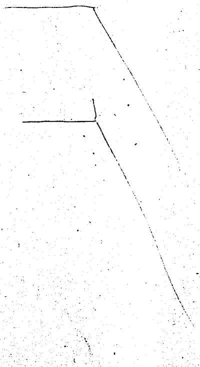


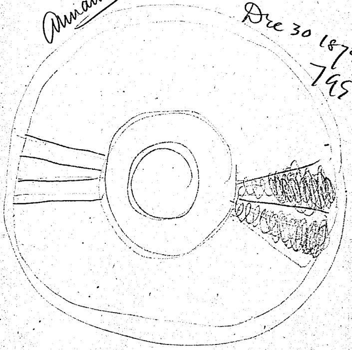




Armature 5X9

Dec 30 1878

795



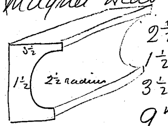
New Magneto Mach — Dec 31 1878

Armature Cylinder — C Batchelor

9 in long
5 " ~~thick~~ diameter
¼" thick

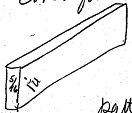
Shaft for same
9" long
2" thick — round solid

Magnet Head



2½ radius
1½ thick
3½ broad.
9 in. long

Cores for armature Spools



1¼ in deep. (long)
5/16 " thick
wide

pattern

Pitch of thread 10

Wheel (driving)

Diam - 9.61 in

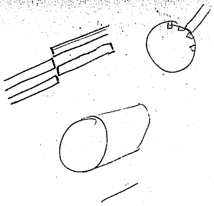
Pitch " 9.05 in

Width 5/8 in

hole in hub 1 in

Disc spokes

300 teeth (spiral cut)



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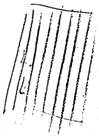
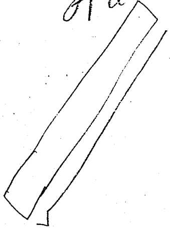




Armatures for same

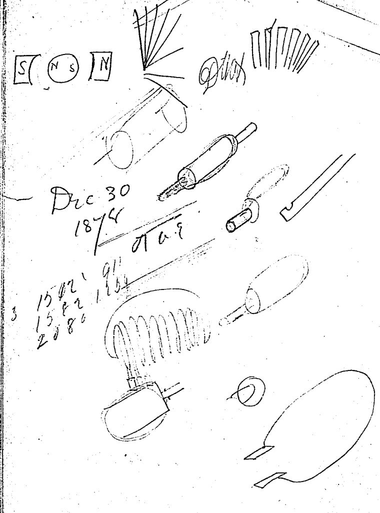
Edison Armature

Siemens Armature

Gramme Armature

Siemens Armature with stationery magnet

226



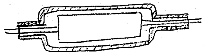
Dec 30
1878

Chas Batchelor Dec 31st 1878 227

Edisons Magneto Electric Mach.

1 Commutator finely divided

2 Armature must be made to revolve round a stationery core so



3 The stationery core must be wound with wire and put in circuit with field magnets thus putting part of field in most concentrated part.

4 The armature & poles will then stand thus:—

so that we throw loops through a very concentrated field

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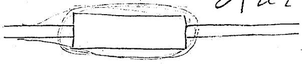

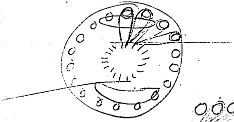

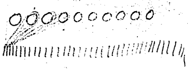

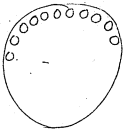

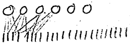

Edison's Mag. Elec Generator Dec 31st 1878
Chas Batchelor

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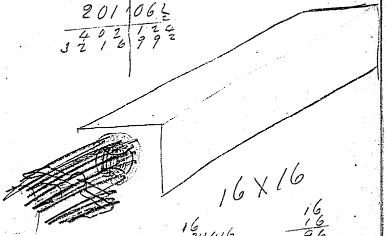

16 X 16

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3.1416
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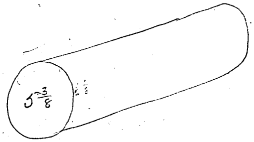
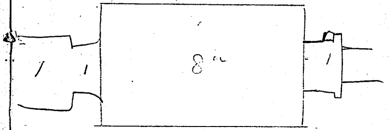
.2617
22519
19302
6434
838.6719



$5\frac{3}{8} \times 16 \times 4$

$2\frac{11}{16} \times 8 \times 4$



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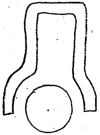

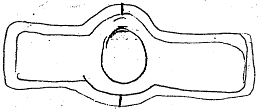

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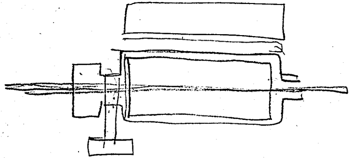

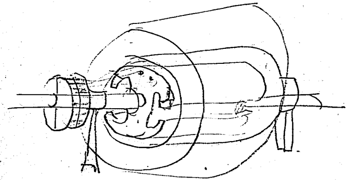

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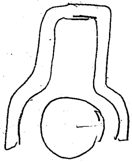

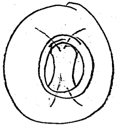

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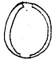

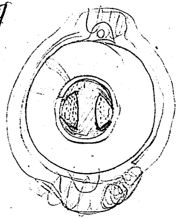

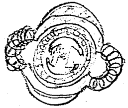

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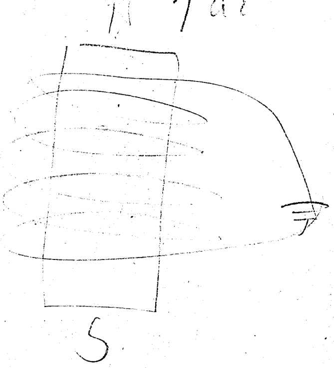

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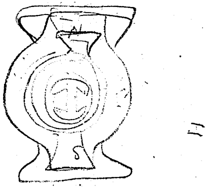

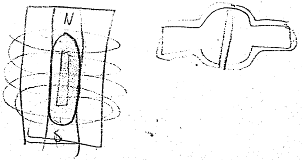

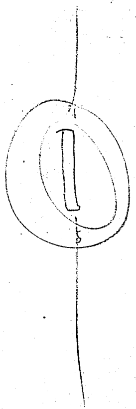

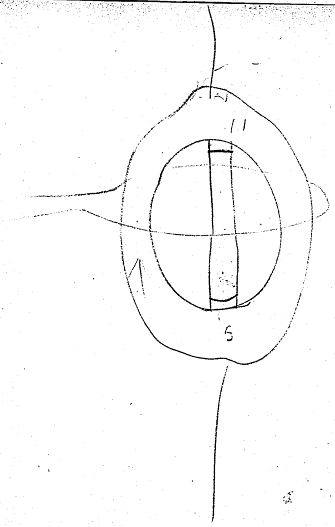
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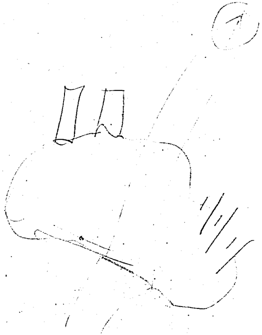

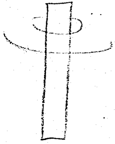

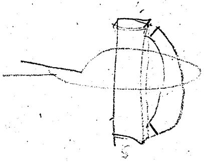

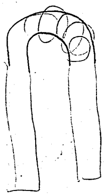

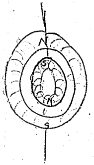
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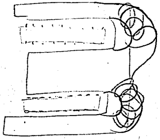

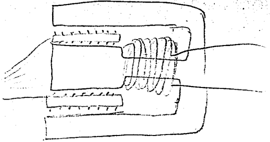

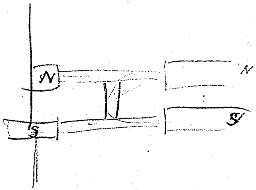
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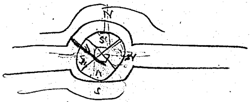
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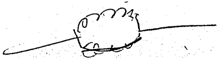

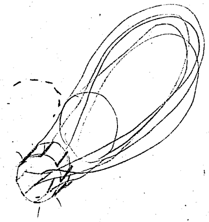

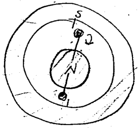

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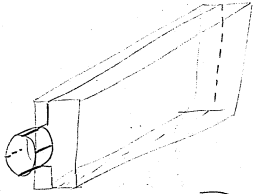
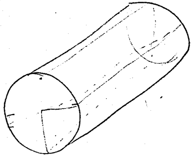
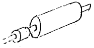
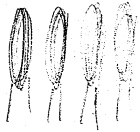


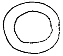


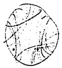
Electro Magnetic Mach.

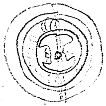
Jan 1 1879
Chas Batchelor

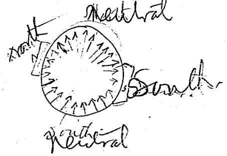











Neutral
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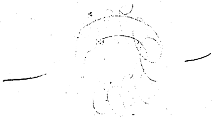

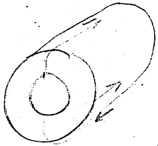

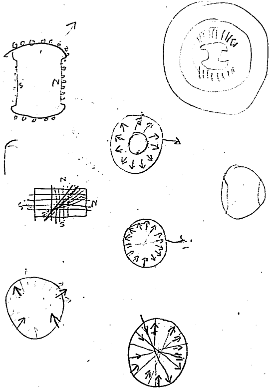
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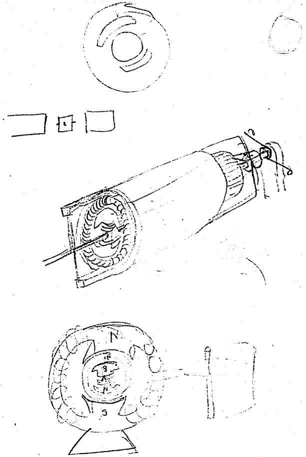
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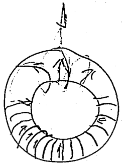

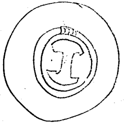

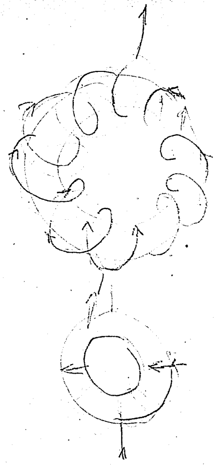

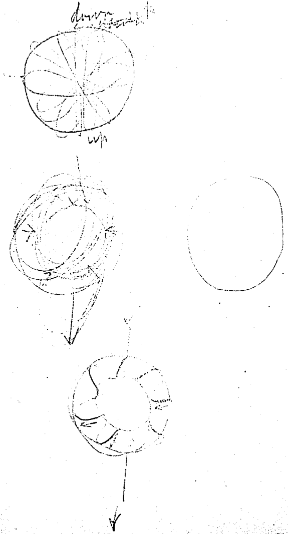
down
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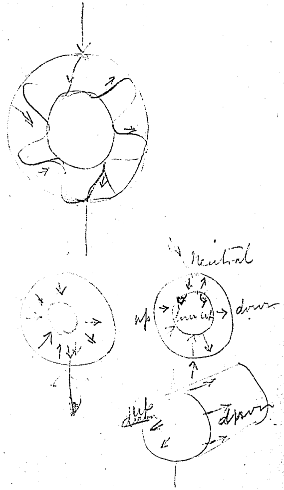
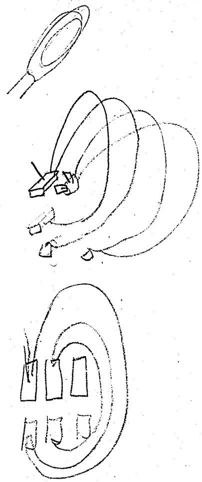
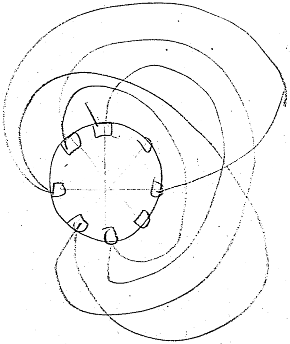
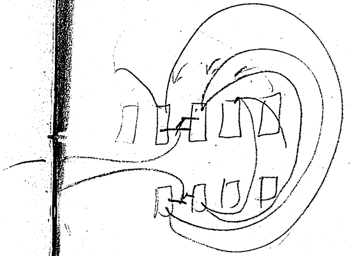
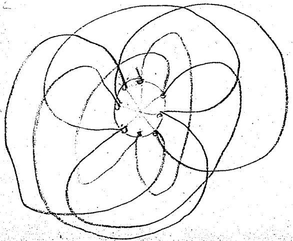
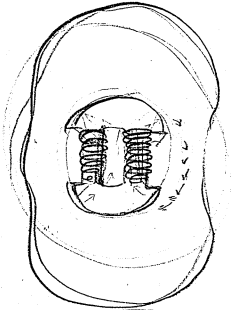

Neutral
up
down
Up
Down

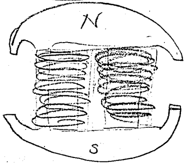








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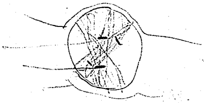
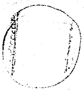
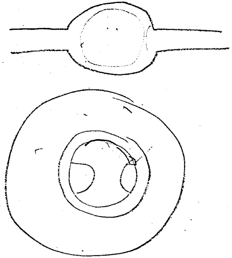
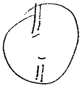
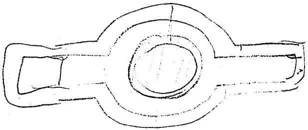
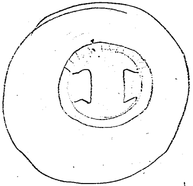












21
8
168.

2

Grum
2

16.

16
16
96
96
1056

52

1 1/2
2
3 1/2
1/2

3/4

21.

2
4

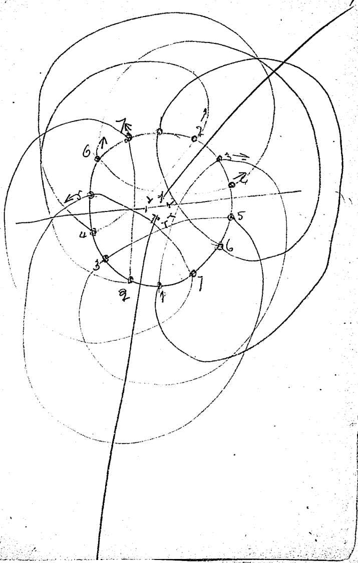
10 1/2
5 1/4

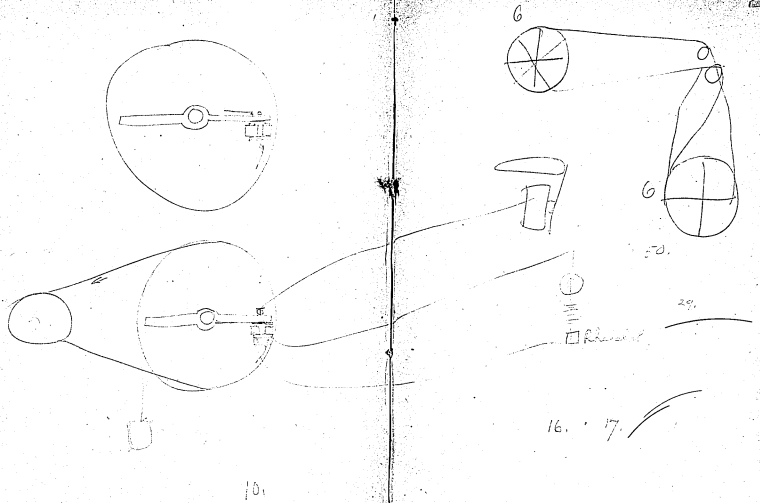
3

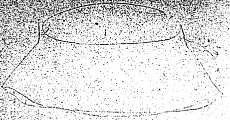
645 feet

45.
43
135
180
1935
4
7740
12 90
12
2580

129
6
7740




6
6
50.
29.
16.
17.
10.



Hoyt's Cable

12 - 4 ft pulley 2000 mm

80 H.P. .4

350
12
4200

17 2 8 6
3 6 5

12
4
410 | 48

26
32

16
80
1280

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